DECEPTION DETECTION IN A COMPUTER-MEDIATED ENVIRONMENT:

GENDER, TRUST, AND TRAINING ISSUES

THESIS

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Abstract

The Department of Defense is increasingly relying on computer-mediated communications to conduct business. This reliance introduces an amplified vulnerability to strategic information manipulation, or deception. This research draws on communication and deception literature to develop a conceptual model proposing relationships between deception detection abilities in a computer-mediated environment, gender, trust, and training. An experiment was conducted with 119 communications personnel to test the proposed hypotheses. No relationship between gender or trust and deception detection accuracy was found. Partial support was found showing that training improves deception detection accuracy. The most significant finding was that individuals' deception detection abilities deteriorate in lean media environments. The results showed significant differences in deception detection abilities across media types; indicating lower accuracy rates in the lean media environments (i.e. audio and text). This suggests that deception detection is more difficult when the deceptive message is presented in a lean medium, such as a text only online chat, than when delivered in richer medium. Future research should be conducted to further explore this finding.

DECEPTION DETECTION IN A COMPUTER-MEDIATED ENVIRONMENT: GENDER, TRUST, AND TRAINING ISSUES

I. Introduction

"Oh what a tangled web we weave, when first we practice to deceive!" Sir Walter Scott

Overview

Deception is a prevalent practice in everyday interactions. It is estimated that twenty five percent of all communications contain deception or perceived deception (DePaulo et al., 1996; Buller and Burgoon, 1996b; Turner et al., 1975). In addition, research has shown humans can only accurately detect about half of the deception they encounter (Miller and Stiff, 1993; Vrij, 2000; Zuckerman et al., 1981). The pervasiveness of deception is a threat to the Department of Defense's information and decision-making superiority. Compounding this problem is the increasing use of information technology (IT) for communication, data storage, and information gathering (Biros, 1998; Biros et al., 2002; Research Consortium, 2001). Currently, little research exists investigating deception and its detection over electronic media. However, the available research suggests it will be more difficult to detect deception in a computer-mediated environment (Biros, 1998; Biros et al., 2002; George and Carlson, 1999a; George and Carlson, 1999b; Research Consortium, 2001). Continuing research in this area could advance the United States Air Force's effort to gain information and decision making superiority.

This thesis effort is focused on adding the Air Force's effort to gain information and decision making superiority, by exploring receivers' possible information processing biases pertaining to deception detection, and their ability to be trained to detect deception. This chapter will provide an introduction to the topic of the deception detection. The following chapter will review the relevant literature, and propose hypotheses and a conceptual model to be tested. Chapter Three will outline the methodology for testing the proposed model, and Chapter Four will present the results of the experiment conducted. Finally, Chapter Five will present the discussion and implications of the findings.

Problem Statement

The use of IT has become prevalent in today's society, and its popularity only continues to grow (Mohan, 1995). The growing prevalence of IT has transformed society socially, economically, and politically (Sheridan, 2000). For many, computers have become a piece of everyday personal and organizational life. Information systems are used to store, process, and share critical information from bank account transactions to classified meeting proceedings. Much of the communication that was once conducted face-to-face is now taking place through electronic means, such as video conferencing, electronic mail, shared databases, and computer conferencing (Biros, 1998; Dennis and Kinney, 1999; George and Carlson, 1999a; Wachter, 1999).

The proliferation of computer-mediated communication (CMC) has had many effects on society. The use of various electronic means of communication has offered

numerous advantages to both organizations and individuals. Computer-mediated communication offers the ability to quickly relay messages and information across large geographical gaps, and the means to immediately filter and store that information for rapid retrieval at a later time (George and Carlson, 1999b). Another advantage of IT in general, recognized by both Joint Vision 2020 and the Air Force Information Operations (IO) doctrine, is the dramatically reduced time between information collection and information availability (AFDD 2-5, 1998; Joint Vision 2020, 2000). Because of the numerous advantages and the increased availability of IT, organizations have come to rely on technology applications for critical functions. In the military, for example, Joint Vision 2020 (2000) identifies information processing abilities and communication networks as the core of every military activity, and a key enabler to victory.

In the recent military confrontation in Afghanistan, Operation Enduring Freedom, CMC has become the primary means of communication. The United States Central Command (CENTCOM) has taken advantage of available technologies to establish a network containing critical intelligence information, and provide a secure means of communication (Ackerman, 2002). The system allows for immediate communication between the different levels in the chain of command, via online chat. The system is capable of numerous tasks including displaying maps which show troop positioning, collecting and processing inputs from unmanned aerial vehicles and ground based personnel, and rapidly broadcasting alerts and information to all levels in the chain of command (Ackerman, 2002; Associated Press, 2002). This example illustrates that military decision makers are continually developing a reliance and dependence on information systems to gather and disseminate critical and sensitive information.

This reliance on and increased use of IT, CMC in particular, increases organizations' vulnerability to strategically altered information or messages (Biros, 1998; Biros et al., 2002; George and Carlson, 1999a; George and Carlson, 1999b; Research Consortium, 2001; Zmud, 1990). The Air Force IO doctrine admits the reliance on information systems is the "Achilles' heel" of America. In addition, the doctrine notes that adversaries including terrorists, criminals, hackers, and unfriendly countries are using the electronic environment to accomplish their malicious goals (AFDD 2-5, 1998). One method adversaries can use to accomplish malicious goals via electronic media involves altering, deleting, or inserting false information in the electronic messages or storage systems in order to present deceptive data to the decision maker. Buller and Burgoon define deception as "a message knowingly transmitted by a sender to foster a false belief or conclusion by the receiver" (Buller and Burgoon, 1996:205).

Deception within information systems can take many forms. A few typical examples of deception in a computer-mediated environment include intruders masquerading as legitimate users on a system and coders generating counterfeit electronic mail. Imagine the damage that could be experienced if deception were implanted in the aforementioned information system being used in Operation Enduring Freedom. Consider this fictitious scenario illustrating the damage that could be imposed on the Air Force through this type of threat. Suppose an adversary masquerading as a senior ranking official issued orders to carry out an attack that would actually result in leading the troops into a trap. Even posing as lower ranking ground personnel, the adversary could transmit the location of a friendly target to a weapons platform for input

into precision-guided munitions. This fictitious example shows the life-threatening errors that can result from the introduction of deceptive information in a military system.

Decision makers often rely on databases, other electronic information storage devices, and computer-mediated communications to gather critical information in the decision making process, thus increasing their vulnerability to strategic information manipulation (Biros, 1998; Zmud 1990). The United States Military defines *military deception* as an offensive and defensive operation that circulates misleading information causing adversary decision makers to act in accordance with the sender's objectives (JP 3-13, 1998). A high-priority goal of the Air Force outlined in the IO doctrine is counterdeception, which is to ensure that friendly decision makers are aware of the military deception presented by adversaries and that they respond accordingly (AFDD 2-5, 1998). However, it is difficult to perform counterdeception if the deceptive information is not identified as such. Currently available automated protection mechanisms cannot easily identify deception in electronic media. Therefore, system administrators, users, and individual decision makers are often relied on to judge the veracity of information (Biros, 1998; Biros et al., 2002; George and Carlson, 1999; Research Consortium, 2001). For this reason, it is vital to understand humans' ability to detect deception over electronic media. However, this is a very new concern and little literature exists on the topic.

Background Information

The issue of deception in warfare is not a new concern. In 500 BC, Sun Tzu noted "All warfare is based on deception" (Clavell, 1983:11). The Joint Doctrine for Information Operations identifies the increasing use of information technologies to support the military as a "double edge sword" in that they have developed both the opportunity to exploit adversaries in new ways, and new areas that the warfighter must protect (JP 13-3, 1998). In essence, the increase in IT has formed a new battlespace for the military referred to as the *infosphere*. Within the infosphere, both offensive and defensive measures are taken to take advantage of and protect information systems (AFDD 2-5, 1998; Joint Vision 2020, 2000).

Deception and concerns about detecting deception fall into the area of information operations known as information warfare. Information warfare is defined by the Air Force as the information operations defending friendly information and information systems or attacking enemy information or information systems (AFDD 2-5, 1998). Although the definition concentrates on information and information systems, an important aspect of information warfare is that the ultimate targets of the operations are the human decision makers (Joint Vision 2020, 2000). Military deception is categorized under both defensive and offensive information warfare operations. However, the detection of deception, which is of interest to this research, is a process necessary to perform counterdeception, a defensive counterinformation (DCI) activity. The Air Force doctrine identifies DCI activities as the most imperative information warfare priority (AFDD 2-5, 1998). Regardless of this, the challenge of detecting deception in the dynamic information environment is only briefly addressed in the doctrine. Developing

an understanding of human ability to detect deception in a computer-mediated environment should also be a high priority for the Air Force. It is impossible to defend the decision making process from introduced deception if deception is not detected.

Deception is also a subject of interest in the academic environment. Researchers from diverse disciplines have been exploring various aspects of deception for decades (Kalbfleisch, 1994; Research Consortium, 2001). Deception research has concentrated on such areas as defining deception (Buller and Burgoon, 1994a; Ekman, 1985), identifying reliable cues to deception (Zuckerman and Driver, 1985; Zuckerman et al., 1981), exploring deceptive behaviors within relationships (McCornack and Parks, 1986; McCornack and Levine, 1990), examining individual ability to detect deception (Ekman, and O'Sullivan, 1991; Kalbfleisch, 1994; Vrij, 2000), and training effects on deception detection ability (deTurck et al., 1990; deTurck, 1991). Still, little research exists that examines deception in a computer-mediated environment. This gap in research has recently been identified and is being addressed by academics (Biros, 1998; Biros et al., 2002; George and Carlson, 1999a; George and Carlson, 1999b; Research Consortium, 2001).

Realizing that deception within a computer-mediated environment is an immediate and growing problem to the military, a group of experienced researchers from many disciplines gathered to work on a project investigating various aspects of deception within information systems. This project, Detecting Deception in the Military Infosphere: Improving and Integrating, is sponsored by the Air Force Office of Scientific Research (AFOSR). The project is now in its second year and is working towards six objectives that will further the Air Force's efforts to obtain information and decision

making superiority. The six objectives as outlined in the annual performance report to AFOSR are as follows:

1) Integrate numerous academic theories to create a unified model of deception detection.

2) Identify through experimental research reliable cues of deceit received under various communication modes, and information-processing biases and heuristics that may inhibit the receiver from appropriately detecting deception.

3) Document lessons learned to further the understanding of deception detection.

4) Create a training curriculum for deception detection.

5) Develop automated aids to assist individuals in deception detection.

6) Test the integrated training program and the automated tools in a military environment (Research Consortium, 2002).

During the first year of the project, the research team has taken great strides toward the above six objectives. They have conducted many experiments that are furthering their knowledge of deceptive behavior; the newly gained knowledge will be utilized to develop training programs and automated tools for deception detection. One example, called the mock theft experiment, is designed to help the Air Force understand deceptive behaviors in a formal interview situation. The experiment involves interrogating participants (some honest and some deceptive) over various types of media (face-to-face, audio, and synchronous chat) (Research Consortium, 2002).

The information gathered, in the numerous studies conducted by the group, is being used to develop training curriculum, training software, and automated detection tools. The training curriculum is being created based on academic theory developed over several decades of deception studies, the new information garnered from this project, and

other current research. The training covers particular cues to help individuals recognize deception. The training lectures, examples of deceptive scenarios with accompanying expert analysis, and other learning features are being incorporated into a prototype of a training software system called Agent99. Agent99 is a virtual classroom designed to teach individuals how to detect deception in a variety of settings (Research Consortium, 2002). Although this progress is impressive, there are still many aspects of deception detection in a computer-mediated environment that need to be explored in order to meet the six listed objectives.

Research Focus

This thesis effort will be adding to the effort of the AFOSR project, Detecting Deception in the Military Infosphere: Improving and Integrating, described above. In particular, this study will further the objectives of identifying information processing biases in receivers, creating a training curriculum for deception detection, and testing that training curriculum in a military environment. In order to add to the knowledge about information processing biases, this study will examine if the media characteristics, the receiver's gender, or the receiver's disposition to trust has an influence on deception detection accuracy.

Electronic media provides communication messages with less available cues (Daft and Lengel, 1986), and individuals rely on cues to detect deception (Buller and Burgoon, 1996b); therefore it may be harder to detect deception communicated with electronic media (George and Carlson, 1996b). This research will investigate the role

media characteristics play in deception detection ability. Specifically, are individuals more accurate at deception detection in a media rich environment? Past research has suggested that females are better at detecting deception, due to their ability to interpret nonverbal cues (deTurck, 1991). Does this gender difference exist in a computer-mediated environment where many nonverbal cues are not available to the receiver? Also, this research will investigate the role of the receiver's trust level in deception detection ability. If a person is generally trusting, will they be less accurate at detecting deception?

In the effort to create a training curriculum for deception detection, the research experiment will test the effectiveness of the current training curriculum developed by the research team delivered via three different formats: traditional classroom lecture, software based training via the Agent99 virtual classroom, and a combination of lecture and Agent99 training. Does training improve deception detection accuracy? Answering the above research questions will further the understanding of deception detection capabilities, and help the research team meet the objectives of identifying information processing biases and developing and testing training curriculum. The specific research questions for this study are listed below.

1) How do the communication medium characteristics affect the ability to detect deception?

2) How does gender influence deception detection accuracy?

3) Do gender effects vary depending on the communication medium characteristics?

4) How does one's disposition to trust affect deception detection accuracy?

5) How does training affect deception detection accuracy?

Contribution to Theory and Practice

Exploring these areas of deception detection may also add to theoretical knowledge that will help fulfill the objective of creating a unified model of deception detection. Understanding more about receivers' possible information processing biases and ability to be trained to detect deception will help the research team identify areas that should be further investigated or possibly ruled out as insignificant. In addition, this experiment could provide empirical support for constructs already included in or being considered for the model.

Whether or not the research effort helps the research team meet the first objective, it will still offer a considerable contribution to theory and practice. Very few studies have examined possible gender differences in deception detection abilities and, in particular, deception detection in a computer-mediated environment. Exploring this area will help academics better understand an inadequately explored issue in deception detection. Furthermore, knowing if a gender difference exists will allow for training programs to be designed with this difference in mind. If individuals have different natural abilities, they will benefit from varied training programs. Understanding any gender differences that are present will help organizations vulnerable to deception to take these differences into consideration when choosing personnel for particular jobs. The study of the relationship between trust and deception detection accuracy will also add to both theory and practice in a similar manner.

Increased understanding and knowledge of deception detection abilities will not only add to academic knowledge and aid the Air Force in its effort for information superiority, but it can also benefit civilian organizations. Civilian organizations are vulnerable to numerous types of deception (Biros, 1998; George and Carlson, 1999a; George and Carlson, 1999b). One example of deception in a civilian organization is the practice of altering resumes in order to obtain a desired job. An experiment currently being conducted, as part of the AFOSR project, involves analyzing the manipulation of resumes by participants. This experiment will allow the team to identify strategies deceivers may use to present deceptive information (Research Consortium, 2002). This garnered knowledge will help civilian organizations better understand resume manipulation and possibly identify ways to recognize false claims.

Computer-mediated deception recently upset many customers of an online payment service, PayPal. Deceptive coders generated counterfeit e-mails soliciting PayPal customers for their account information (Cox, 2002). PayPal lost credibility, and possibly customers, due to this incident. This example delineates the fact that computer-mediated deception is not only a military concern, but also a problem for civilian organizations.

Summary

This chapter discussed the growing prevalence of IT and computer-mediated communication and pointed out how these technologies increase vulnerabilities to information manipulation. Additionally, the need to explore deception and the ability to

detect it in a computer-mediated environment was stated, and the particular research focus of this thesis effort was delineated. The following chapter will review the literature on deception, deception detection, communication medium characteristics, gender differences, trust, and deception detection training. Specific hypotheses concerning the relationship between deception detection accuracy, gender, communication medium, trust, and training will be proposed. Chapter Three will outline the methodology for conducting the research, including characteristics of the population, an explanation of the experiment, and the data collection techniques. Chapter Four will provide the results of the experiment and data collection. Finally, Chapter Five will present the discussion of the findings, limitations of the research, implications of the results, and suggestions for further study.

II. Literature Review

Introduction

This chapter reviews literature relevant to the study of deception detection in a computer-mediated environment, and presents and defines the constructs of a proposed deception detection model. First, deception literature from the communications field is reviewed. Then, other applicable areas of literature, including computer-mediated communication, trust, gender, and training, are reviewed. Finally, a theoretical model and related hypotheses for the current research effort are presented.

Deception Literature

To begin understanding deception detection in a computer-mediated environment, an examination of existing human-to-human deception research is beneficial. As mentioned in the previous chapter, extensive research examining deceptive communication exists. Deception research relevant to the current research effort includes the prominent deception theories, Interpersonal Deception Theory (Buller and Burgoon, 1996b) and Information Manipulation Theory (McCornack, 1992), the believed nonverbal and verbal indicators of deception (Buller and Burgoon, 1994a; Burgoon et al., 1995; DePaulo, 1992; Zuckerman and Driver, 1985), and the ability of individuals to detect deception (DePaulo et al., 1985; Comedena, 1982; McCornack and Parks, 1986).

Early research attempted to investigate various aspects of deception using an experiment that required participants to lie about their feelings while viewing unpleasant slides (Brandt et al., 1980; Ekman and Friesen, 1974; Miller et al., 1983). These experiments requested that the participants attempt to convincingly report they were in a content emotional state while viewing horribly graphic pictures of burn victims (Miller et al., 1983). Although this research offered enlightening findings about many areas of deception, deception experts have argued this is not an adequate research design because it does not take place in the same environment as the majority of deceptive communication (Buller and Burgoon, 1996b).

Buller and Burgoon argue that this impersonal research design does not generalize well to real-world situations; they point out that deception typically occurs in, and therefore should be studied in, an interactive context (Buller and Burgoon, 1996b; Buller and Burgoon, 1994a; Burgoon and Buller, 1994). As a result of this and several other research conclusions, the authors proposed Interpersonal Deception Theory (ibid). Interpersonal Deception Theory (IDT) provides a theoretical framework for predicting and explaining the dynamics of deception during human-to-human interaction (Burgoon et al., 1995). IDT focuses on deception in the context of a communication exchange; the theory is based on the key assumption that communication is comprised of goal-oriented strategic and nonstrategic behaviors (Buller and Burgoon, 1996b). IDT posits that successful deception requires the conscientious management of both strategic and nonstrategic behaviors during communication in order to deliver a believable message to the receiver. On the other hand, successful deception detection requires the receiver to

recognize the sender's effort or failure to manage the content of the message (Buller and Burgoon, 1994a).

Nonverbal Behavior

The "nonstrategic" behaviors that Buller and Burgoon (1996b) refer to are the inadvertent and possibly unconscious actions of the sender such as body movements, pitch changes, nonfluencies, or facial expressions. These behaviors are often identified as the nonverbal indicators of deception (DePaulo, 1992; Zuckerman et al., 1981). Nonverbal behaviors are the messages in a communication exchange other than the actual words, consisting of both visual and paralinguistic (or vocal) cues (Miller and Stiff, 1993). Deception research has extensively explored the area of nonverbal behavior and its relationship to deception (Burgoon et al., 1996). Ekman and Friesen proposed that regardless of the sender's effort to strategically manage information, nonverbal behavior has a tendency to unintentionally occur, or "leak," during deception (Ekman and Friesen, 1974; Ekman, 1985). This proposition is commonly accepted as a fact among deception researchers; thus, the inadvertent occurrence of nonverbal behavior is frequently referred to as leakage. The abundance of research in this area has led to the discovery of several reliable nonverbal indicators of deception.

While there has been substantial research completed on nonverbal behavior cues to deception, many of the studies' findings are contradictory (Vrji, 1998). Zuckerman and colleagues attempted to identify reliable cues by compiling the literature that examined the correlates of deception (Zuckerman et al., 1981; Zuckerman and Driver,

1985). Zuckerman and Driver (1985) completed a meta-analysis in which they identified nine nonverbal cues to deception. The visual cues the authors identified include increased pupil dilatation, increased blinking, increased adaptors, decreased facial segmentation, and increased body segmentation. Adaptors are activities in which the sender is moving his or her hand while touching their body, such as scratching (deTurck and Miller, 1985). Zuckerman and Driver (1985) also identified that deceptive messages contain the following paralinguistic cues: shorter response length, higher speech pitch, increased speech errors, and hesitations. While these nonverbal behaviors have been identified as reliable indicators of deception, researchers have proposed that different cues are present depending on the situational variables (Miller et al., 1983; Vrij and Mann, 2001).

The situational variables of the deceivers' level of arousal, amount of motivation, and amount of planning could possibly alter the nonverbal cues present. Leakage of various nonverbal cues may fluctuate depending on the senders' level of arousal. Deceivers are thought to experience arousal as a result of feelings of guilt, fear, or excitement related to deceiving the receiver (Vrij and Mann, 2001). Arousal is associated with the nonverbal cues of pitch increase, increased adaptor gestures, and increased body segmentation (Frank and Ekman, 1997). In addition, arousal is also associated with various physiological deceptive cues; detection aids such as the polygraph are designed to measure these cues (Porter and Yuille, 1995). However, the current research effort is concerned with human detection of deception, and the physiological cues are often not detectable via human observation alone (ibid). A theory similar to the arousal theory states that deceivers will give off varying cues depending on their level of motivation for

success (DePaulo et al., 1988; Burgoon and Floyd, 2000). However, whether high motivation of the deceiver prompts increased control of nonverbal cues, or the increased leakage of nonverbal cues due to heightened arousal, remains a subject of debate (Burgoon and Floyd, 2000). Furthermore, the increase in the amount of planning time available to the deceiver has been proposed as a variable that decreases the availability of nonverbal cues (Miller et al., 1983). Zuckerman and Driver (1985) found that the deceivers who were given more planning time were able to decrease their response latencies and increase their speech rates, thus removing the availability of two vocal deception cues. Given that nonverbal cues are sometimes hard to measure (i.e., voice pitch or pupil dilation), and that the cues vary depending on the situation, it is beneficial to explore the verbal cues related to deception.

Deceptive Strategies

One way to identify the verbal indicators present in deceptive messages is to determine how deceivers present deceptive messages as opposed to truthful messages. In other words, how do senders strategically present the information in order to deceive the receivers? Researchers agree that deceivers alter or manipulate verbal content across various dimensions when creating a deceptive message (Buller and Burgoon, 1996a; Burgoon et al., 1996; McCornack, 1992). Regardless of the agreement that deceptive messages vary in systematically identifiable ways, theories explaining these systematic message variations contradict each other. Two widely discussed theories that attempt to identify dimensions of information manipulation are McCornack's (1992) Information

Manipulation Theory (IMT) and Burgoon and colleagues' (1996) Information Management Theory.

Information Manipulation Theory (McCornack, 1992) is built on Grice's (1989) Cooperative Principle of communication and conversational maxims. The principle focus of IMT is that deceptive messages are derived by violating the conversational maxims through concealed manipulation of verbal content (McCornack, 1992). The conversational maxims, which when violated can be considered an attempt at deceptive communication, are quantity, quality, manner, and relation (ibid). The first maxim of quantity considers the amount of sensitive information the sender reveals; a deceptive message may contain too much information or exclude critical information. The maxim of quality refers to the veracity or truthfulness of the message. Deceptive communication lacks quality, in that deceptive messages contain distorted or entirely fabricated information. The maxim of relation represents the relevance of information communicated in a message; a deceiving sender will possibly insert irrelevant information into the exchange in order to divert the conversation topic. Finally, the maxim of manner refers to the sender's clarity when presenting information. An ambiguous message violates the maxim of manner, and possibly contains deceptive information. IMT proposes that a violation of one or more of the four conversational maxims occurs during deception. Because IMT is based on linguistic properties of deceptive messages, the theory aids in the identification of verbal cues and also helps identify deceptive messages that are presented as text only (Biros, 1998).

Burgoon and colleagues (1996) introduced Information Management Theory as another method to analyze the verbal behavior of deceptive messages. The authors refer

to Information Management Theory as a theory that expands on the maxims proposed in IMT based on the principles of IDT (Buller and Burgoon, 1996). Burgoon and colleagues suggest that verbal content is strategically managed along five dimensions, as opposed to the four maxims of IMT, during deceptive communication. These dimensions include informational and conversational completeness, actual and apparent veridicality, semantic and syntactic relevance/directness, semantic and syntactic clarity, and personalization (Burgoon et al., 1996). Information and conversational completeness refer to the amount of information revealed in a communication exchange, similar to the maxim of quantity. The next dimension of veridicality is the amount of truthfulness in the message, which is comparable to the IMT maxim of quality; however, Information Management Theory includes both actual deception and perceived deception. The dimension of relevance, analogous to the IMT maxim of relation, refers to the content directness and grammatical relevance of the message. Clarity, the fourth dimension of Information Management Theory, is equivalent to the IMT maxim of manner, which refers to the amount of equivocation or ambiguity in a statement. Burgoon and colleagues (1996) consider both semantic and syntactic clarity to be of importance and interest in potentially deceptive messages. The last Information Management Theory dimension, personalization, does not relate to any of the IMT maxims. Personalization is the amount of immediacy the sender portrays in the message, or the extent to which ownership of the statement is accepted (Burgoon et al., 1996). In general, Information Management Theory suggests that deceivers will attempt to strategically manage verbal content by creating incomplete, dishonest, indirect, ambiguous, and impersonal messages (Buller and Burgoon, 1994b).

Although these theories diverge in some aspects, the summary of IMT and Information Management Theory provided above delineates the corresponding ideas presented within the two theories. Both of these theories concentrate on the linguistic content of communicated messages, and hence, will be helpful in identifying verbal characteristics of deception (Burgoon et al., 1996; McCornack, 1992). Considering the majority of research has concentrated on the nonverbal correlates of deception, this new focus on verbal content will undoubtedly broaden the understanding of deception.

Verbal Behavior

As acknowledged by researchers, the literature and knowledge about verbal correlates to deception is deficient (Burgoon et al., 1996; McCornack, 1992; Miller and Stiff, 1993). Verbal, or linguistic, indicators are present in the actual words and content of a communication exchange (Miller and Stiff, 1993). Given the lack of research on verbal correlates of deception, these cues are even less agreed on than the nonverbal cues discussed above. Zuckerman and Driver (1985) attempted to identify reliable verbal correlates of deception through a meta-analysis of deception literature.

In addition to nine nonverbal cues, Zuckerman and Driver (1985) identified four reliable verbal cues to deception. Zuckerman and Driver (1985) suggest that deceptive communication will contain more negative statements, irrelevant information, and leveling, while portraying less immediacy. A less immediate statement is one in which the sender attempts to distance or disassociate himself or herself from the deception through such tactics as speaking in the passive voice and past tense (Kuiken, 1981).

Leveling is usually associated with overgeneralizations, such as every, always, never, and everyone (Buller and Burgoon, 1996b). Another proposed verbal indicator of deception is fewer specific references; a deceiver will use more group references and avoid using first person pronouns (Cody et al., 1984; DePaulo et al., 1985; Stiff and Miller, 1986). Verbal indicators, like nonverbal indicators, are subject to situational variables. The situational variables of the deceivers' level of arousal, amount of motivation, and amount of planning could affect both nonverbal and verbal indicators of deception. Another situational variable that could change the verbal content of the message is the subject matter being discussed (Miller and Stiff, 1993). For example, depending on the question being asked, the answer may call for less immediate replies or more group references; even if the reply is truthful it may contain cues of deception, and result in perceived deception (DePaulo et al., 1985).

Although there are less agreed upon reliable verbal correlates of deception, these indicators are more generalizable across media than the nonverbal correlates. In less interactive contexts, such as a computer-mediated environment, receivers have limited access to nonverbal cues (Buller and Burgoon, 1996b; George and Carlson, 1999b). If the medium is text only, the receiver only has access to verbal cues and some of the paralinguistic cues. The paralinguistic cues that could be seen in a text only situation include shorter response length, increased speech errors, and, in synchronous text communication, increased hesitations (George and Carlson, 1999b). Realizing the usefulness of verbal cues, academics have recently increased investigations in this previously research-deficient subject (Burgoon et al., 1996, Miller and Stiff, 1993).

Although the above nonverbal and verbal behaviors are considered reliable correlates of deception, deception researchers stress that no common or universal behavioral cue set exists to identify deception across all individuals; therefore, receivers must concurrently consider all the indicators in the context of the communication exchange (DeTurck and Miller, 1990; Zuckerman and Driver, 1985). A reliable indicator of deception, which does not fit in either the verbal or nonverbal category, is discrepancy (Zuckerman and Driver, 1985). DePaulo argues that inconsistency between an individual's nonverbal behavior and the concurrent linguistic message is the most reliable indicator of deception (DePaulo, 1992). However, receivers often fail to depend on reliable cues, such as discrepancy or increased adaptors; rather, novices and specialists alike often base deception judgments on unreliable behaviors, such as shifty eyes and fidgeting (DePaulo et al., 1985; Vrij, 1998). The erroneous belief that these behaviors are associated with deception is a factor in the poor deception detection ability of individuals (ibid).

Detection

Of highest interest to this research endeavor is the ability for individuals to detect the difference between deceptive and truthful messages, or the detection accuracy of individuals. Miller and Stiff (1993) argue that communications researchers should measure both the ability to detect deception and truth, because increasing knowledge of ability to recognize truth will add to the understanding of deception. Although some researchers (Miller and Stiff, 1993) differentiate between deception detection accuracy

and detection accuracy, for the purpose of this study these terms are synonymous. Regardless of the accumulated knowledge concerning deception, deception detection accuracy still only averages near 50 percent (DePaulo et al., 1985). These poor detection rates may be a result of reliance on undependable behaviors, as mentioned above; however, researchers have offered numerous other explanations of deception detection performance.

Another hindrance to accurate deception detection is the inability of receivers to observe cues due to the practice of communicating via leaner media (Buller and Burgoon, 1996b; George and Carlson, 1999b). Communication via an information system removes the receivers' ability to examine all of the senders' behaviors (Buller and Burgoon, 1996b). Text-based communications, such as electronic mails or online chat sessions, restrict access to visual cues and allow the receiver to analyze only the linguistic and some paralinguistic cues (Rice, 1993). A richer CMC, video conferencing, allows access to the majority of the cues; however, research suggests that using this communication medium will nevertheless inhibit receivers' ability to detect deception due to masking or distortion of cues in low quality video (Horn, 2001; Horn, 2002). Overall, the characteristics of the communication medium can reduce the number of observable cues available to the receiver, thus hindering detection abilities (Horn, 2001; George and Carlson, 1999a; George and Carlson, 1999b).

However, past research suggests that the lack of cues may actually increase detection accuracy (Maier and Thurber, 1968). The research of Maier and Thurber suggested that individuals exposed only to audio or written communications were better able to identify deception than the participants of an interactive interview. The

researchers attributed this finding to the fact that the receivers' were distracted by the senders' nonverbal cues, and concluded that the visual cues limited the receivers' processing ability (Maier and Thurber, 1968). However, the researchers never formally tested the hypothesis, and when the hypothesis was tested, by other researchers, it received no empirical support (Miller and Stiff, 1993).

More recently, researchers have suggested the richness level of CMC is not a permanent property; rather, it can vary depending on the knowledge base of the participants and the social context surrounding the communication (Carlson and Zmud, 1999; Markus, 1994; Ngwenyama and Lee, 1997; Schmitz and Fulk, 1991). Carlson and Zmud (1999) point out that users build knowledge bases about the communication media, the conversation topic, the organizational context, and the other participants. These experiences allow the receiver to extract rich information from even a message delivered in a text only format (Carlson and Zmud, 1999). Thus, an individual experienced in these domains may be able to better utilize available cues to successfully detect deception in a computer-mediated environment (George and Carlson, 1999b).

Another explanation for poor deception detection ability is the highly individualistic nature of deception; people differ in the cues they leak during deception and the same people may leak different cues, depending on the situational factors surrounding the deceit (Miller et al., 1986; Vrij and Graham, 1997). Considering the highly idiosyncratic nature of deception, the knowledge about a particular individual's behavior during deception is most likely more valuable than the general indicators of deception offered by Zuckerman and Driver (1985). Zuckerman and colleagues (1984) investigated this idea, and found that exposure to baseline information about the sender's

idiosyncrasies increased the receivers' detection accuracy when judging the veracity of that particular sender.

This line of reasoning led to the hypothesis that people involved in a relationship would be capable of more accurately detecting deception from their partners than strangers (Comedena, 1982; Knapp, 1984). However, studies examining detection accuracy between relational partners did not support this hypothesis (Comedena, 1982; McCornack and Parks, 1986; Miller and Stiff, 1993). McCornack and Parks (1986) suggested that this lack of ability might be due to an individual's tendency to presume the other member of the relationship is being honest. The researchers labeled this predisposition the "truth bias" (McCornack and Parks, 1986:380). The existence of a truth bias diminishes the receivers' motivation to detect deception; therefore, they will put less effort in discerning truthful behavior from deceptive behavior. Although findings from initial tests of the truth bias hypothesis questioned its validity, it has been empirically supported, and generalized to include strangers (Levine and McCornack, 1992; Stiff et al., 1992). The truth bias concept has become a widely accepted concept among deception researchers, and is often cited as a factor that negatively influences detection capabilities (Buller and Burgoon, 1996b; DePaulo et al., 1985; Levine and McCornack, 1992; Stiff et al., 1992).

A factor closely related to the truth bias construct is an individual's level of trust; a high level of trust in the communication partner is correlated with a lower motivation to detect deception and an increased truth bias (Levine and McCornack, 1992; McCornack and Levine, 1990). Research in this area has been conducted mostly with relational partners (couples and friends), given that people within a relationship have an

opportunity to build trust (Levine and McCornack, 1992; McCornack and Levine, 1990; Stiff et al., 1992). However, Biros (1998) explored how humans' trust level in computer systems related to deception detection accuracy, and hence truth bias. Although the study did not support the truth bias construct, it contributed to the understanding of user truth bias toward computer systems (Biros, 1998). Overall, research has demonstrated an individual with a high level of relational trust is more likely to presume honesty when discerning the veracity of a message.

Another factor that may influence detection accuracy is the receivers' level of suspicion. Unsuspicious receivers are not motivated to scrutinize communication content for deception, and alternatively rely on the truth bias to judge veracity (McCornack and Parks, 1986). Suspicion has been described as a pertinent requirement for successful deception detection (DePaulo et al., 1980). When receivers have their suspicion level aroused, their motivation to carefully analyze communication content for deceptive content increases, therefore decreasing their reliance on the truth bias (Levine and McCornack, 1992; Millar and Millar, 1998). Although aroused suspicion counteracts the dependence on the truth bias, it does not necessarily increase detection accuracy (Burgoon et al., 1994; Toris and DePaulo, 1985). Under conditions of aroused suspicion, individuals often assume truthful messages contain deception, resulting in a false alarm (Levine and McCornack, 1991; Toris and DePaulo, 1985). Levine and McCornack (1991) identified this tendency to presume deception as the lie bias. In conclusion, although aroused suspicion provides an increased motivation to detect deception, it may cause detection accuracy to decrease given the reliance on the lie bias.

Although this set of factors is not comprehensive, the issues discussed are fundamental to the understanding of deception and deception detection ability. Collectively, the research presented highlights that deception takes place in varied interactive social contexts, which include a sender, a receiver, and the message being communicated. Miller and Stiff (1993) provided a conceptual model that encompasses many of the factors involved in a deceptive transaction. George and Carlson (1999b) modified this model to address more recent concerns of deception research including communication medium characteristics and experience level. George and Carlson's (1999b) adapted model of deceptive communication is presented below in Figure 1, and discussed further in the following section.

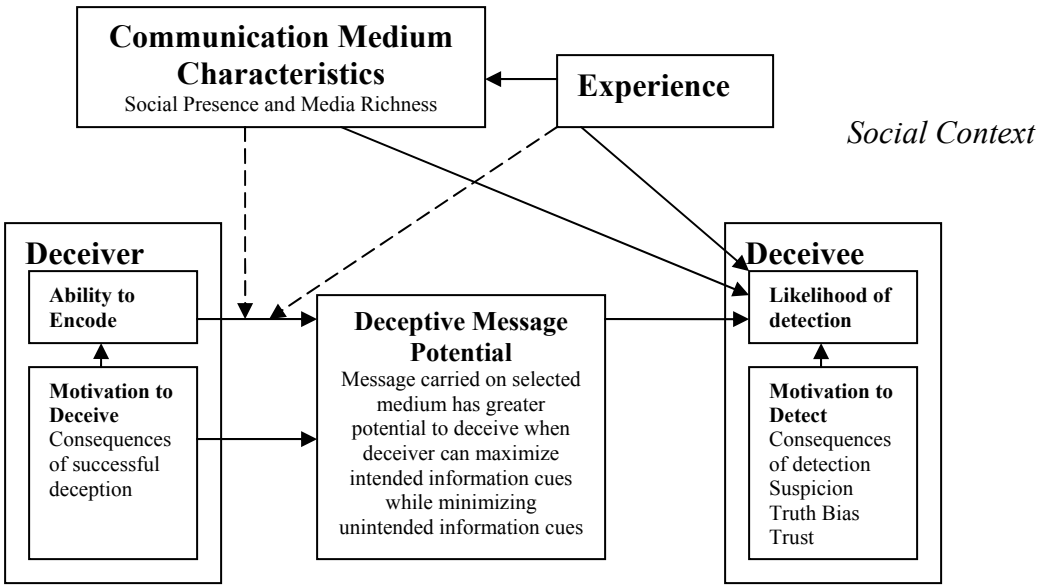

Figure 1: George and Carlson's Adapted Model of Deceptive Communication (simplified)

Adapted Model of Deceptive Communication

George and Carlson's model is adapted from Miller and Stiff's (1993) model of deceptive communication (George and Carlson, 1999b). The model presented above

delineates the complexity of deceptive exchanges. Following is a brief description of the model. The exchange begins with the deceivers, or senders, taking into consideration their motivations to deceive, using their ability to encode information to transmit the potentially deceptive message. The deceptive message potential is based on the ratio of intended versus unintended information conveyed in the message. George and Carlson posit that the relationship between deceiver and deceptive message potential is moderated by the communication medium characteristics and the experience level of the participants. The deceivees', or receivers', likelihood of successful deception detection is dependent on their motivation to detect deception, their utilization of available cues, the delivery mode of the message, and the experience level of the individuals involved in the communication. The whole deceptive communication process takes place in a distinct social context. George and Carlson's model shows deceptive communication as a transaction, offering a view that includes the encoding and the decoding of the potentially deceptive message.

However, the current research effort is only concerned with the right side of the model, the receivers' decoding abilities. Of particular interest are the constructs of trust, as a hindrance of motivation to detect deception; communication medium characteristics, as a factor in deception detection accuracy; and the receivers' likelihood of detection success. These areas will be explored in depth in the following sections. Although the other constructs are important, they are beyond the scope of this study.

Characteristics of the Medium

Communication media vary in their capability to overcome situational communication constraints and transmit social, symbolic, and nonverbal cues (Short et al., 1976; Daft and Lengel, 1986; Rice, 1992). Currently, the widely accepted theories for explaining the differing characteristics of communication media are Social Presence Theory and Media Richness Theory. Both of these theories suggest classifications of media based on the medium's ability to represent various types of information. These theories were initially developed without consideration for electronic media such as video conferencing, online chat, or electronic mail, but academics later expanded the theories to accommodate these innovative media types (Daft et al., 1987; Rice, 1993). Social Presence Theory and Media Richness Theory discriminate media based on different dimensions, and provide different continuums on which to rank media based on these dimensions (Short et al., 1976; Daft and Lengel, 1986).

Short and colleagues (1976) define social presence as the degree that a medium is able to convey the perception of the conversational participants' physical presence. Social Presence Theory differentiates media based on the levels of immediacy and intimacy that it can portray (Short et al., 1976). Social Presence Theory asserts that media differ in their ability to: reveal social roles, support human interactivity, and convey nonverbal cues, such as facial expressions, body language, and tone of voice (Olaniran, 1995). Using these dimensions Short and colleagues presented a continuum on which the social presence of media could be ranked. Face-to-face communication is considered the most socially present media, given that it provides for the highest exhibition of nonverbal cues, social roles, and interactivity (Short et al., 1976). The other

media are considered less socially present as follows, in descending order: television, multispeaker audio, telephone, and business letter (ibid).

Media Richness Theory, previously called Information Richness Theory, is similar to Social Presence Theory; both theories differentiate media based on the amount of information they can effectively convey to the participants (Carlson and Davis, 1998; George and Carlson, 1999b). Media richness is based on the premise that different media have different capacities for transmitting comprehensible data (Daft et al., 1987). Daft and Lengel (1986) propose that media are differentiated based on their capabilities to provide feedback, communicate cues, present personalized messages, and support the use of varied language. Like Social Presence Theory, Media Richness Theory ranks face-to-face communication at the top of the continuum, as the richest media. The rest of the continuum, however, slightly diverges from the social presence scale. The rank order of media in terms of richness is face-to-face interaction, telephone conversation, electronic mail exchanges, personal written text, formal written text, and formal numeric text (Lengel and Daft, 1988). Figure 2 represents the media richness hierarchy as presented by Lengel and Daft (1988).

Media Richness Hierarchy

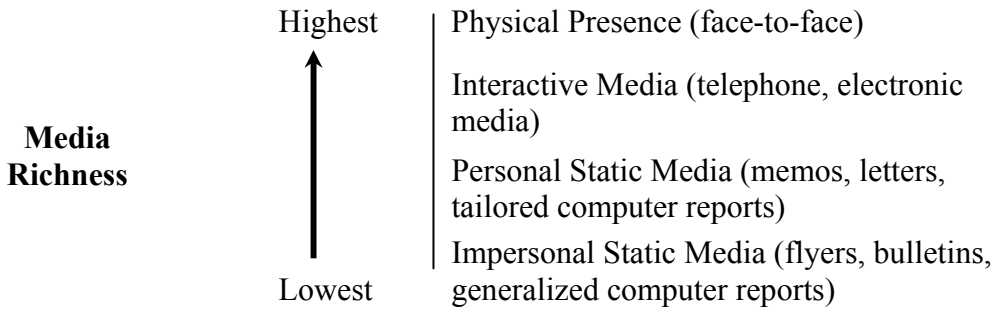

Figure 2: Media Richness Hierarchy

Media Richness Theory proposes it is the goal of organizations to process information in a format that reduces uncertainty and equivocality; therefore, managers will more likely use rich media for equivocal tasks in an effort to reduce ambiguity (Daft and Lengel, 1986; Daft et al., 1987). Similarly, Social Presence Theory suggests that to achieve desired results, mangers should match the need for social presence with the medium used to communicate (Short et al., 1976). Due to the similarities of social presence and media richness theories, academics are beginning to informally merge the two theories. The recent literature commonly addresses only one of the two theories, or refers to media richness/social presence when discussing the characteristics of media (Carlson and Davis, 1998; Rice, 1992; Straub and Karahanna, 1998). Given the interrelatedness of these theories, a common assumption is that a medium high in richness is also high in social presence (ibid); this assumption will be employed throughout the remainder of this thesis.

Although Media Richness Theory was originally developed to explain the use of different media within organizations (Daft and Lengel, 1986), researchers immediately began applying the theory to explain mangers' media selection (Trevino et al., 1987). Later, researchers also began using Social Presence Theory to describe media choice rationale (Straub and Karahanna, 1998). Much of the empirical research supporting Media Richness Theory tests the theory's ability to predict management selection of media rather than media use (Daft et al., 1987; Russ et al., 1990; Trevino et al., 1990; Trevino et al., 1987).

The usefulness of media richness and social presence theories as a tool for media selection has been debated by academics (Carlson and Davis, 1998; Carlson and Zmud, 1999; Markus, 1994; Ngwenyama and Lee, 1997; Schmitz and Fulk, 1991). The arguments against Media Richness Theory argue that media characteristics are not objective definitive characteristics, but rather dynamic and individualistic depending on the situational and social context of the communication (Carlson and Zmud, 1999; Markus, 1994). However, the current study is not investigating media selection, but rather medium characteristics. Given that media richness and social presence theories effectively categorize media as related to the amount of cues available in various types of media, these theories are appropriate for use in this research effort.

Motivation to Detect

George and Carlson's adapted model of deceptive communication lists suspicion, truth bias, and trust as a part of the receivers' motivation to detect deception (George and Carlson, 1999b). These concepts are all discussed above in relation to detection accuracy; however, truth bias and trust warrant further discussion. Of particular interest to this research effort is how truth bias and trust are linked. The premise of truth bias is that trust acts as a "biasing agent that detrimentally influences accuracy" (Levine and McCornack, 1992:144). An individual that has developed a truth bias will experience a lack of motivation to analyze messages for cues to deception (Levine and McCornack, 1992; Stiff et al., 1992).

Truth bias has been conceptualized behaviorally (McCornack and Parks, 1986) and cognitively (Stiff et al., 1992; Miller and Stiff, 1993). McCornack and Parks (1986) measured truth bias by the number of times a participant judged their partner as honest. Other researchers viewed this method as inadequate, and chose to instead view truth bias as a cognitive heuristic (Stiff et al., 1992; Miller and Stiff, 1993). These researches operationalized truth bias with a short questionnaire, which asked the participant questions about their trust towards their partner (Levine and McCornack, 1992; Stiff et al., 1992). Stiff and colleagues (1992) argued that this is a more appropriate measure of a bias than the behavioral approach used by McCornack and Parks (1986). Although it has not been adequately explored, it is possible that an individual's basic trusting nature may also act as a biasing agent that negatively affects accuracy. The following section will review the trust literature related to this suggestion.

Trust

Trust is an imperative concept both for effective social interactions and technology use (Johnson-George and Swap, 1982; Muir 1987). Trust is considered vital in relationships along a wide range of intimacy levels, from the relationship between an employee and an employer to a romantic relationship (Whitener et al., 1998). In addition, recent literature has suggested trust is also a key factor for effective performance in a virtual environment (Muhlfelder et al., 1999). Trust is an immensely complex concept; comparing results of trust research across studies and fields is problematical due to the numerous contradictory definitions and measurements of trust (Barber, 1983).

The definitions of trust vary greatly in breadth, yet tend to be narrowly defined within research endeavors (Kee and Knox, 1970; McKnight and Chervany, 2002). Trust has been defined as: a behavior (Zand, 1972), a general expectancy (Rotter, 1980; Rotter, 1967; Wrightsman, 1991), a belief or set of beliefs (Barber, 1983; Rotter, 1967), a situational variable (Johnson-George and Swap, 1982), and an interpersonal variable (Rempel, Holmes and Zanna, 1985). McKnight and Chervany (2002) performed an in-depth review of the trust literature across numerous disciplines. They concluded that the current confusion surrounding trust research needed to be resolved. In an effort to meet this objective, the authors developed a classification system for the different types of trust and a model conceptualizing how the different types of trust interrelate (McKnight and Chervany, 2002).

McKnight and Chervany's literature review identified three major trust types, impersonal/structural, dispositional, and personal/interpersonal, which they use as classification categories. McKnight and Chervany's impersonal/structural category refers to trust based on social or institutional structures rather than personal aspects. The category of dispositional trust refers to an individual's basic sense of trust across various situations. Personal trust is the trust one individual sends to another, while interpersonal trust is the trust exchanged between two or more people. All of the categories are situation dependent except dispositional trust (McKnight and Chervany, 2002).

Given that communicating in a computer-mediated environment involves both the interaction with people and systems, trust within CMC could be categorized as personal/interpersonal or impersonal/structural. In addition, it could be argued that an individual's general disposition to trust is also an important concept in a computer-

mediated environment; considering, that by definition this type of trust is consistent across various situations and people (McKnight and Chervany, 2002). For the purpose of this study the most generalizable category of trust, dispositional trust, will be considered.

The concept of dispositional trust was originally developed by Rotter (1967, 1971) and has been expanded on greatly by other academics (Couch and Jones, 1997; Erikson, 1968; Wrightsman, 1974; Wrightsman, 1991; Zand, 1972). The definition offered by Rotter suggested trust is the generalized expectancy that the agreement of an individual or group can be relied upon (Rotter, 1967; Rotter, 1971). This conceptual view of trust has also been referred to by many different names such as: basic trust, global trust, trust in human nature, generalized trust, and trusting nature (Couch and Jones, 1997; Erikson, 1968; Wrightsman, 1974; Wrightsman, 1991). Rotter (1967) originally referred to this type of trust as interpersonal trust; however, as the concept evolved theorists considered the description too broad to be limited to interpersonal trust (McKnight and Chervany, 2002; Wrightsman, 1991). In order to emphasize the constructs' generalizability, and to conform to McKnight and Chervany's (2002) proposed trust classification, this type of trust will be referred to as dispositional trust, or simply trust, throughout this study.

An individual's dispositional trust cannot be related to one particular event or to one person. Rather, it is derived from a collection of experiences and generalized to all situations (Rotter, 1967, Stack, 1978). A key distinction between dispositional trust and other types of trust is the idea that this level of trust is constant across diverse situations and individuals. In fact, this concept is the foundation of McKnight and Chervany's definition of dispositional trust, which refers to a "consistent tendency to trust across a

broad spectrum of situations and persons" (McKnight and Chervany, 2002: 37). The suggestion that dispositional trust is consistent regardless of situational circumstances is aligned with the proposition that dispositional trust is a personality characteristic or trait (Couch and Jones, 1997).

In addition to the factors that George and Carlson (1999b) present in their adapted model of deceptive communication, there may be other factors that influence the receivers' ability to detect deception. In particular, the possibility of adding the constructs of gender and training will also be explored in the sections below.

Gender

Past research has demonstrated that broad communication differences between men and women exist, in that they have different communication norms and expectations (Borisoff and Merrill, 1992; Meyers et al., 1997). Sex differences have been demonstrated in the areas of connection, cooperation, competition, and conflict (Borisoff and Merrill, 1992; Hawkins and Power, 1999; Meyers et al., 1997). In addition, gender differences have been explored specifically in relation to computer-mediated situations and deception detection.

Studies have examined gender differences in many computer-related topics such as: computer anxiety (Qureshi and Hoppel, 1995), computer skills (Harrison and Rainer, 1992), and factors influencing computer usage (Allen and Griffeth, 1997; Gefen and Straub, 1997; Venkatesh et al., 2000). Research has also examined gender differences in the areas of perceptions of media richness, social presence, and CMC (DeGreef and

Ijsselsteijn, 2000; Dennis and Kinney, 1999; Gefen and Straub, 1997; Savicki and Kelly, 2000).

In relation to social presence and media richness, the gender difference findings are somewhat contradictory. Dennis and Kinney (1999) concluded from their studies in Media Richness Theory that females' decision quality was more negatively affected by the use of lean media than males. The authors' hypothesize that this difference is due to females' higher sensitivity to nonverbal communication (Dennis and Kinney, 1999). The authors claim women send and interrupt messages more clearly using nonverbal cues; the lack of cues may be more detrimental to female performance because of their reliance on nonverbal cues for communication (Briton and Hall, 1995; Dennis and Kinney, 1999). However, in a recent social presence research academics concluded that women consistently perceive lean media (such as electronic mail) higher in social presence than males (Gefen and Straub, 1997; Greef and Ijsselsteijn, 2000). These results seem conflicting; Greef and Ijsselsteijn (2000) suggest this may be the product of a response bias in the social presence studies.

Gender differences have also been explored within deception studies (Blanck et al., 1981; Cody and O'Hair, 1983; deTurck, 1991; and McCornack and Parks, 1987). The deception research does not reach a consensus as to the relationship of gender and deception. This may be due to the various angles the researchers choose to relate gender and deception. For example, Cody and O'Hair (1983) examined how the correlates of deception differed between the genders. Zuckerman and colleagues (1981), who were also investigating sex differences in relation to deceptive cues, concentrated on which gender was better at reporting nonverbal cues. The studies of Blanck and colleagues

(1981), McCornack and Parks (1987), and deTurck (1991) all measured gender effects on deception detection accuracy. All of these studies demonstrated that women were better able to detect deceit than men. However, each study was conducted under different contexts. The study of Blanck and colleagues (1981) was a longitudinal study designed to measure detection ability over time, while McCornack and Parks (1987) measured accuracy within relationships, and deTurck (1991) measured gender differences in relation to training effects on detection accuracy. Regardless of the divergent nature of the studies, one common theme did emerge in that the authors of each study proposed an explanation of the results as the difference of nonverbal decoding abilities of men and women (Blanck et al., 1981; Cody and O'Hair, 1983; Dennis and Kinney, 1999; deTurck, 1991; McCornack and Parks, 1987). Overall, women are better at decoding, understanding, and utilizing nonverbal cues than men (Briton and Hall, 1995).

Training

Another aspect of deception detection that warrants exploration is the ability of individuals to learn to better detect deception. Several researchers have investigated the relationship of deception detection training and detection accuracy (Biros, 1998; Biros et al., 2002; Bull, 1989; deTurck, 1990; deTurck, 1991; Porter et al., 2000; Zuckerman et al., 1984). Research has shown the best way to improve deception detection success is a combination of feedback on practice judgments and training on reliable behavioral deception cues (Feeley and Young, 1998; Feeley and deTurck, 1995; Porter et al., 2000; Research Consortium, 2001).

Although these suggestions may seem intuitive, past deception detection programs for police officers have failed to include either of these essential elements (Bull, 1989). The police officer deception training program typically suggests that the detection of deception is a simple straightforward task, and it fails to address common misconceptions associated with deception (Akehurst et al., 1996). One study actually confirmed the ineffectiveness of this program; it showed that individuals trained to employ a common interrogators' technique performed significantly worse on deception detection tasks than the untrained participants (Kassin and Fong, 1999). In addition, by virtue of the real life environment in which they operate, police officers often are not privy to immediate feedback relating to their deception judgments (Porter et al., 2000). Given that this professional training program yielded unsuccessful results when methodologically tested, academics have continued to investigate deception detection training options.

Research investigating the use of immediate feedback to improve deception detection accuracy has provided conflicting conclusions (deTurck, 1991; Porter et al., 2000; Zuckerman et al., 1984). Zuckerman and colleagues (1984) used feedback about senders' veracity as a training mechanism. The researchers found that feedback relating to a particular sender's messages will improve detection success only when presented with messages from that sender, not across diverse senders. They concluded from this finding that feedback allowed receivers to become familiar with the particular sender's distinctive behaviors correlated with deception (Zuckerman et al., 1984). However, Porter and colleagues (2000) surprisingly found that a group receiving feedback on their past deceptive judgments performed better than the group not privy to any feedback. The

authors suggest that participants may have used the feedback to identify valid deception cues, and then modified their decisions in light of past experiences (Porter et al., 2000). Other researchers have used feedback as a supplement to other training efforts (deTurck, 1991; deTurck et al., 1991). The researchers offered feedback to practice judgments in addition to providing information on deception cues, and the combination was found to improve detection accuracy.

The concept of offering participants particular information about the cues of deception began research in more in-depth training. The consistency of training varied greatly across the studies reviewed; training sessions varied in content, length, and delivery mode. For example, one study simply offered the participants a handout describing cues of deception (DePaulo et al., 1982), whereas other researchers have conducted extensive training programs including information on deception history and examples of the deceptive cues (Porter et al., 2000). In the early studies of deTurck and colleagues (1990 and 1991), described above, in addition to the feedback on practice scenarios, the participants in the treatment group also received a handout defining deception cues and had an instructor who demonstrated each cue. The training sessions for these studies lasted about half an hour and were relatively simple. On the other hand, Porter and colleagues (2000) offered a training program that they referred to as a workshop, which discussed deception history, typical myths about deception, and a detailed explanation of the correlates to deception. Other research has taken a completely different approach and opted to instruct the participants using a taxonomy of deceptive tactics (Biros et al., 2002; Biros, 1998). The diversity of training programs makes it difficult to generalize the results found in the studies. Vrij (2001) asserts that the lack of

a standard adequate training program is the source of the divergent findings of training studies.

The results of experiments investigating training demonstrate the lack of generalizability caused by the diverse training curriculum. DePaulo and colleagues (1982) suggested that the participants trained on vocal cues will perform significantly better. Other researchers (deTurck, 1991; deTurck et al., 1997; deTurck et al., 1990; deTurck and Miller, 1990; Fiedler and Walka, 1993) concluded that the combination of feedback and training will result in a significantly better detection rate. On the other hand, some researchers have found training to have no significant effect on detection accuracy (Biros et al., 2002).

Regardless of the stated success with training participants to detect deception, known problems exist with the current training methods. First of all, many academics have noted that training increases suspicion which in turn increases the occurrence of false alarms, or identification of truthful statements as deceptive (Biros, 1998; Biros et al. 2002; Burgoon and Buller, 1994; Feeley and Young, 1998). The increase in false alarms decreases the accuracy in truth detection; at the same time, the increase in identifying deception counteracts this enough to still allow for an overall better detection performance (Feeley and Young, 1998). This shows that the training programs may be less effective in teaching participants to detect deception than the results convey.

Another known problem with the majority of existing training methods is the fact that knowledge may be lost before the individuals are faced with a situation in which they could employ it (Biros et al., 2002; Globerson and Korman, 2000). Biros and colleagues (2002) suggest the novel approach of providing just-in-time training, or training that is

delivered immediately before it is to be employed. Delivering just-in-time training to participants significantly increased performance; however, this method also increased the occurrence of false alarms (ibid).

Overall, the use of training to improve deception detection has a promising outlook. Although receivers commonly utilize unreliable indicators and biases when attempting to decipher deception from honesty, it has been demonstrated that these practices can be changed by educating individuals (Biros et al., 2002; deTurck, 1990; deTurck, 1991; deTurck and Miller, 1990; Fiedler and Walka, 1993; Porter et al., 2000; Zuckerman et al., 1984).

Presentation of Conceptual Model

This thesis effort will be exploring the receiver's ability to detect deception. In particular, the study focuses on the effects of characteristics of communication medium, gender, trust, and training on detection accuracy. The model presented below, Figure 3, shows the proposed relationships of these constructs.

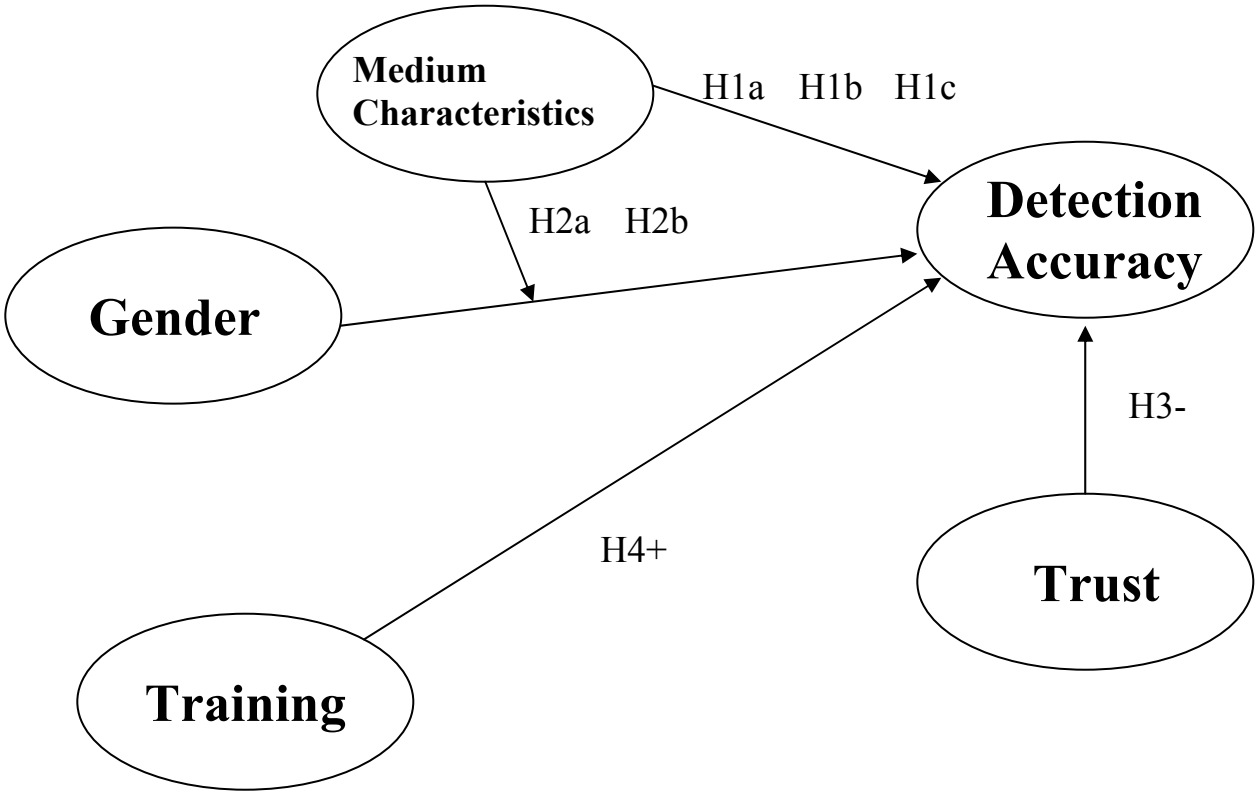

Figure 3: Proposed Model

Deception Detection Accuracy

The dependent variable for this experiment is detection accuracy. Some researchers have only measured the participants' accuracy in relation to deception; however, it has been argued that communication researchers should measure both the ability to detect deception and truth (Miller and Stiff, 1993). Therefore, detection accuracy will be defined as the ability of individuals to detect the difference between deceptive and truthful messages.

Characteristics of the Medium

Research in CMC investigates the effects of computer-mediated interaction on decision making (Baltes et al., 2002; Hedlund et al., 1998; Dennis and Kinney, 1998; Dennis and Kinney, 1999). The majority of this research relates to group decision making, however these results may be generalizable to individual decision making situations. The most consistent finding in the literature is that decisions take more time to make in a computer-mediated environment (ibid). Some studies showed that decision accuracy also suffered when groups were given a judgment task and asked to reach a census in a computer-mediated environment (Straus and McGrath, 1994). Overall, Baltes and colleagues (2002) concluded from a meta-analysis including 52 studies that decisions made in a computer-mediated environment were of less quality than decisions made face-to-face.

These conclusions are especially alarming when the possibility of deception is introduced. It is possible that CMC users will also make poor decisions when confronted with deception in a computer-mediated environment, hence decreasing their detection accuracy. In experiments conducted by Horn (2001), it was found that individuals attempting to detect deception in messages delivered via reduced quality video in a video conferencing situation were significantly less successful than individuals viewing high quality video. This finding suggests that communication medium characteristics affect deception detection accuracy.

Medium characterized as rich and high in social presence allow for observation of more nonverbal cues, than lean medium low in social presence (Daft and Lengel, 1986; Short et al., 1976). For the purpose of this study, three levels of media richness and

social presence will be explored. The media are video, audio, and text, listed from highest level of richness and social presence to lowest. Given that detection is dependent on the receivers' successful detection of deception cues, and fewer cues will be available in lean media environment, deception ability could be hindered in a lean media environment. The following hypotheses are proposed suggesting media richness will have a significant positive effect on detection accuracy:

H1a: Deception detection accuracy will be significantly higher when judging video messages than when judging text messages.

H1b: Deception detection accuracy will be significantly higher when judging video messages than when judging audio messages.

H1c: Deception detection accuracy will be significantly higher when judging audio messages than when judging text messages.

Gender

As the military's percentage of female personnel steadily increases, it is important to explore the differences women bring into the workplace, or in the case of communications, the infosphere. Past research has demonstrated that women are better at deception detection than men (Blanck et al., 1981; Cody and O'Hair, 1983; deTurck, 1991; and McCornack and Parks, 1987). It has been posited that women rely more on nonverbal cues to determine deception, and that they are better at decoding nonverbal cues in all situations (DePaulo and Rosenthal, 1979; Hall, 1978; Rosenthal and DePaulo, 1979). Other research asserts that females perform better at person related perception and discrimination tasks (Falbo, 1975), and are more accurate judges of emotion than males

(Rosenthal and DePaulo, 1979). These assertions all support the results found in the deception studies (Blanck et al., 1981; Cody and O'Hair, 1983; deTurck, 1991; McCornack and Parks, 1987).

However, it is noted that females' decision quality is negatively affected by lean media environments lacking social presence (Dennis and Kinney, 1999). Both of these trends are attributed to the findings that women utilize nonverbal cues differently than men (Briton and Hall, 1995). Women have demonstrated superior processing aptitude when presented with nonverbal cues (Hall, 1978; Rosenthal and DePaulo, 1979). The previous research would suggest that women will have higher detection accuracy in a rich media environment, when nonverbal cues are available for inspection (Blanck et al., 1981; Cody and O'Hair, 1983; deTurck, 1991; McCornack and Parks, 1987). However, given that these cues are not present in lean media (Daft and Lengel, 1986; Short et al., 1976), it is not expected that this advantage would continue to exist in a lean media environment. The following two hypotheses are proposed in relation to gender differences:

H2a: Females will be more accurate at detecting deception than males in a rich media environment.

H2b: No significant gender difference of deception detection accuracy will exist in a lean media environment.

Trust

Researchers have proposed that a relationship exists between dispositional trust and other types of trust (Couch and Jones, 1997; Erikson, 1964; McKnight and Chervany, 2002; Rotter, 1967; Wrightsman, 1974). In particular, academics have argued that

dispositional trust is often the basis of relational trust, especially in unfamiliar situations (Erikson, 1964; Rotter, 1967; Wrightsman, 1974). Dispositional trust is a generalized expectancy to trust; therefore, it will be relied on when no specific information relating to the current situation is available (Rotter, 1971; Jeffries, 2002). An example of this type of situation is an initial meeting with another person; it would be likely that because no history exists between the individuals, they would at this point both rely on their dispositional trust in order to make decisions (McKnight and Chervany, 2002; Rotter, 1967).

The concept of dispositional trust is very similar to the conceptual view of truth bias. This is especially apparent in the work of Zand (1972), who suggests that an individual with low trust will be more likely to detect suspicious behavior from another individual. In addition, it is suggested that dispositional trust influences the interpretation and attention of behaviors and cues during communication involving trust (Rotter, 1971; Zand, 1972). These propositions suggest that dispositional trust is very similar to McCornack and Park's (1986) truth bias, and therefore a suitable parallel to the relational trust referred to by truth bias.

Trust is related to deception accuracy between relational partners (McCornack and Parks 1986; Stiff et al., 1992), and it has been suggested that this relationship is generalizable to strangers (Stiff et al., 1992). The current definition of truth bias would not be suitable it explain the use of the truth bias among strangers, because it refers specifically to a bias developed through interactions with a particular partner (Stiff et al., 1992; Miller and Stiff, 1993). The concept of dispositional trust is very similar to the conceptual view of the truth bias. In addition, it is suggested that trust influences the

interpretation and attention of behaviors and cues during communication involving trust (Rotter, 1971; Zand, 1972). These theoretical propositions suggest that an increased level of dispositional trust will be related to decreased detection ability. The following hypothesis is proposed in regards to trust:

H3: Trust will have a significant negative influence on deception detection accuracy.

Training

Although receivers commonly utilize unreliable indicators and biases when attempting to differentiate deception from honesty, it has been demonstrated that these practices can be changed by educating individuals (Biros et al., 2002; deTurck, 1990; deTurck, 1991; deTurck and Miller, 1990; Fiedler and Walka, 1993; Porter et al., 2000; Zuckerman et al., 1984). However, it is also noted that increased suspicion could possibly increase false alarms, hence decreasing overall detection accuracy (Burgoon et al., 1994). It is likely individuals will knowledgably scrutinize messages for deceptive cues after receiving training, rather than relying on heuristics (including suspicion) to assign veracity (Fiedler and Walka, 1993; Porter et al., 2000). Porter and colleagues' (2000) found in their studies that trained participants better identified honest and deceptive messages, than untrained participants. The following hypothesis is offered in regards to training:

H4: Training will have a significant positive effect on deception detection accuracy.

Summary

This chapter reviewed the literature relevant to deception detection in a computer-mediated environment. A conceptual model and accompanying hypotheses were presented. The following chapter will delineate the research methodology to test the hypotheses suggested in this chapter. Chapter Four will present the analysis of the data, and Chapter Five will discuss the research findings, limitations, and suggestions for further research into this area.

III. Methodology

Overview

The previous chapters described the research problem, provided background information, and reviewed pertinent literature relevant to this thesis effort. A conceptual model was presented, and hypotheses were generated based on the proposed model. This chapter will describe the methodology used to investigate the research hypotheses proposed in Chapter Two. It includes a description of the relevant population, a justification for the chosen trust instrument, and a detailed account of the experiment performed.

Research Methodology

A quasi-experimental nonequivalent control group design was the methodology chosen to test the proposed hypotheses for this thesis effort (Campbell and Stanley, 1966). This experiment was collaboratively designed and accomplished by the academics working on the AFOSR research project described in Chapter One. For this reason, some of the surveys and treatments in the experiment are beyond the scope of this thesis effort. The methodology description will focus on the aspects of the experiment which are related to the hypotheses of this thesis effort. However, the timeline presented in Table 1, which offers an overview of the whole experiment, reports the amount of time allotted for all of the experiment's activities.

As illustrated in Table 1, the experiment was accomplished over four sessions, referred to as sessions zero, one, two, and three. There was a one week lapse between session zero and session one, and two week intervals between the other sessions. The only objective of session zero was to perform preliminary data collection. The other three sessions included testing participants' deception detection abilities and knowledge level, training participants to detect deception, and administering other surveys.

Table 1: Research Design

Session 0	**Time(min)**
AFIT Survey 0 (**Demographics, Trust Measure**, and others)	60
One week lapse	
Session 1	**Time(min)**
Overview Knowledge Pretest 1a	15
Judgment Accuracy Test 1a	15
Overview Training	60
Overview Knowledge Posttest 1b	15
Judgment Accuracy Test 1b and Accuracy Feedback (on both tests)	15
AFIT Survey 1	30
Two week lapse	
Session 2	**Time(min)**
Cues Knowledge Pretest 2a	15
Judgment Accuracy Test 2a	15
Cues Training via three different delivery modes (classroom, software-based, and a combination of classroom and software)	60
Cues Knowledge Posttest 2b	15
Judgment Accuracy Test 2b and Accuracy Feedback (on both tests)	15
AFIT Survey 2 (**Trust measure** and others)	60
Two week lapse	
Session 3	**Time(min)**
Heuristics Knowledge Pretest 3a	15
Judgment Accuracy Test 3a	15
Heuristics Training	60
Heuristics Knowledge Posttest 3b	15
Judgment Accuracy Test 3b and Accuracy Feedback (on both tests)	15
Debriefing and feedback	60

Relevant Population

The argument that deception detection is important to Air Force members was presented in Chapter One, based on the Air Force information operations objectives (AFDD 2-5, 1998). Significant points from that discussion which apply here include: the importance of counterdeception, and the fact that deception detection must be accomplished in order to carry out counterdeception. Information operation activities are largely the responsibility of communication and information personnel (AFMAN 26-2105, 2001). Considering the Air Force is relying on the deception detection abilities of communication and information personnel to detect deception and perform counterdeception, these individuals are the population of interest for this study.

The experiment was conducted on a military installation which provides training to communications personnel, the population of interest. This venue provided a sample of 121 communications personnel, who were undergoing training at the military installation. The participants took part in the experiment as part of their daily training curriculum and were informed the purpose of the experiment was to develop a training program for deception detection. The participants were pre-organized in classes, by the training administrators, based on the date they began their communications training. Eight classes, of approximately sixteen people each, were available to participate in the experiment; participants remained in their previously assigned classes, as not to interrupt their training mission, and two classes were randomly assigned to each of the three

treatment groups, or the one control group. Participation in the experiment was not mandatory, but highly recommended by the training administrators.

The majority of the participants were Air Force officers; however, the study also included some civilian personnel and foreign officers. All the participants had at least a bachelor's degree, and some had obtained higher levels of education. The majority of participants reported spending over fifty percent of their work day and a substantial amount of off duty time on a computer. The Air Force officers all had to attend military training and receive a commission in the United States Air Force in addition to their undergraduate education. Most of the participants were relatively new to the communications field, although some reported prior enlisted experience in the career field. Overall, the average amount of time in the communications field for all participants including prior enlisted time was just over three years. Table 2 provides a summary of the participants' demographics. Appendix A includes a complete list of demographics questions posed. The total number of individuals who provided usable data is 119. The study began with 121 participants; however, one foreign officer chose to withdraw due to a language barrier, and another participant provided unusable data and missed a session of the experiment. Other participants also missed a session of the experiment, but still provided data that can be used to test some of the hypotheses.

Table 2: Demographics of Sample

Demographic Variable	n	Percent Of Sample
Gender		
Male	103	86.6%
Female	16	13.4%
	119	**100%**
Rank		
2Lt	99	83.2%
1Lt	5	4.2%
Captain	4	3.4%
Major	2	1.7%
Lieutenant Colonel	1	0.8%
Civilian	8	6.7%
	119	**100%**
Education		
Bachelor's Degree	112	94.1%
Master's Degree	6	5.1%
Doctoral Degree	1	0.8%
	119	**100%**
Age		
Average (years)	28.0	
Years in Communications Career Field		
Average (years)	3.0	

Trust Measurement

To ensure the reliability and validity of the dispositional trust measurement a preexisting trust instrument (Rotter, 1967) was chosen and administered. Rotter's scale of interpersonal trust is designed to measure the general trusting nature of an individual. The instrument deals with trust in a variety of situations from individuals' trust in other people to their trust in systems, such as the political or judiciary systems (Stack, 1978). This is an ideal measure to use when investigating trust in a computer-mediated environment, where the communicators' trust in both the information system and the other communicator is an issue. The following sections will describe the instrument, provide information regarding the instruments' validity and reliability, and explain the

administration of the instrument for this study. A complete list of the trust items is contained in Appendix B.

The Rotter's trust scale consists of twenty-five items, rated on a five point Likert-type scale. In addition, the original instrument contained fifteen filler items to partially disguise the purpose of the test (Rotter, 1967). The options on the Likert-type scale range from strongly agree to strongly disagree, with the middle option being agree and disagree equally. In order to counter response bias, the response items are reversed for half of the items. To elaborate, for half of the questions the strongly agree response indicates a high level of trust, while for the other half the same response would indicate a low level of trust. Also to counter response bias, half of the questions are worded in the direction of high trust, and the other half in the direction of low trust. This design provides a robust instrument that has demonstrated validity and reliability (MacDonald et al., 1972; Rotter, 1980; Rotter, 1971; Rotter, 1967; Stack, 1978; Wrightsman, 1991).

Rotter went through a rigorous process to ensure scale validity during the instrument design. For example, Rotter (1967) eliminated items from the trust scale that had a high correlation with items on the Marlowe-Crowne Social Desirability Scale in order to reduce the need for social approval (Rotter, 1967; Wrightsman, 1991). The success of Rotter's effort has been reflected in several studies, which confirm the instrument's construct and discriminate validity (Hochriech and Rotter, 1970; Rotter, 1971; Rotter, 1967). The instrument has also shown consistent internal reliability (Wrightsman, 1991). Rotter (1967) reported an overall internal reliability of .76, accompanied by the caveat that additive scales designed to sample social objects are apt to have a lower reliability level than objective type tests. MacDonald and colleagues

(1972) reported a slightly higher Cronbach alpha of .84. Overall, the scale has demonstrated acceptable levels of both reliability and validity, and is appropriate for use in this study.

The trust instrument described above was administered to the participants of the current experiment two separate times, once during session zero and once during session two. As mentioned above, the original instrument contained twenty five trust items and fifteen filler items; however, the survey administered during this study did not include the filler items. Rather, in order to partially disguise the purpose of the questions the trust items were randomly intermixed with questions from a different survey, measuring a topic of interest to another researcher. This tactic allowed for the omission of the original filler items, because it should fulfill Rotter's (1976) only purpose for the filler items, to "partially" disguise the meaning of the survey. The responses to the trust survey were collected via the World Wide Web, as was the rest of the experimental data.

Data Collection Method

Trust survey information and all other test responses were recorded via web-based questionnaires. Using an Internet web-site (http://en.afit.edu/env/dds) to collect the research data provided many benefits. This method not only allowed for an organized presentation of the instruments and minimal paper use, but it also allowed the responses to be directly transferred to a database for analysis. Removing the need for the researchers to transfer the participants' responses from a paper-based survey to an electronic format saves time and minimizes the possibility of error.

The surveys and tests were completed in a classroom setting with a research administrator present. At the beginning of every test the participants were instructed to enter their assigned group number, and their four digit identification number. The participants were tracked throughout the experiment with the combination of these two numbers; allowing for the comparison of demographic information, deception accuracy, and trust level. Each administrator was provided with specific instructions to conduct the survey, and was aware of what questions were considered appropriate to answer. It was ensured that none of the administrators would inform the participants of the purpose of the trust items.

Pilot Study

A pilot study was conducted prior to the actual experiment in order to assess the study in a low risk situation. The participants in the pilot study were nineteen volunteer Air Force Institute of Technology students. All of the volunteers were communications officers who had obtained at least a bachelor's degree and were currently pursuing a communications related master's degree. The individuals in the pilot study group had either previously attended the training program the actual participants were undergoing, or will attend the training program upon receipt of their master's degree. Overall, with the exception of experience level, the pilot study sample was extremely similar to the sample in the actual experiment.

The objectives of the pilot study included testing the technical solution, and obtaining feedback on the design of the experiment and the instruments used to collect

data. The pilot study included a judgment accuracy pre and post-test, a training session on the cues of deception, and a survey containing the trust items and several other measures of interest to other researchers. The participants in the pilot study provided feedback on the readability of the instruments, the quality of the scenarios used for the judgment accuracy tests, and the content of the lecture. In addition, the pilot study allowed for the verification of the technical solution. As a result of the feedback provided, some changes were made to the presentation of the instruments. The complaints about the scenarios used for the judgment accuracy tests were mostly dealing with the audio quality, so the poor quality scenarios were not used in the actual experiment. The pilot study was also beneficial in that it pointed out unforeseen issues that were resolved before the experiment was conducted.

In addition to this pilot study, two other pilot studies were conducted by another institution collaborating in this research effort. These pilot studies were designed to test the appropriateness of the judgment tests and the usability of the software-based training program. Using data from the pilot studies, the judgment accuracy tests were rated on difficulty level; this rating was used to balance the difficulty level of the pre-tests with that of the post-tests. In addition, the studies returned favorable feedback on the usability of the software-based training system, Agent99. Further results of these pilot studies are not of interest to this research effort.

Permission to Conduct the Experiment

Permission to conduct this research was granted by the Air Force Personnel Center's Survey Branch (AFSB) in accordance with Air Force Instruction (AFI) 36-2601, which requires all Air Force surveys be approved and assigned an Air Force survey control number. The survey was approved on 5 August 2002 and assigned control number USAF SCN 02-080. Given this study involved the topic of deception, the experiment was also reviewed by the Human Subjects Review board. An exemption to AFI 40-402 was requested and granted by the Air Force Research Laboratory Human Effectiveness Directorate 17 December 2002.

Experiment Execution

An overview of the experiment was offered earlier in the chapter, and Table 1 was presented to illustrate that description. This section will review in depth the elements of the experiment introduced in Table 1. Session zero consisted of the administration of the initial trust measure, collection of demographic information, and other data collection not of interest to this study. In sessions one, two, and three, the actual experiment was conducted, and each of these sessions was very similar. Of the four groups in the study, three received training and one (the control group) did not. Each session started with a knowledge pre-test and a detection accuracy judgment test for all the groups. Then, the three groups receiving training participated in a fifty minute training session, while the control group was released for a break. Next, all the groups took a knowledge post-test and another judgment accuracy test; upon completion of the tests all the groups were

provided with feedback on their judgment accuracy. Finally, the participants completed surveys measuring various items of interest. The following sections will provide further descriptions of the tests administered, the training provided, and the surveys conducted.

Knowledge Tests

Knowledge tests were administered to all groups twice during each session. The knowledge tests were created by deception experts involved in the AFOSR project. The tests for each session were designed to cover the topic of interest for that particular session, and to assess learning retention from previous sessions. The pre-tests were used to evaluate baseline knowledge on deception topics, and the post-tests were used to determine the effectiveness of the training provided during the session. The pre and post-tests asked the same questions in a different order. The questions on the session one knowledge tests dealt with basic deception knowledge, such as the definition of deception. The session two questions were tailored to test knowledge concerning deception cues, while the session three knowledge tests evaluated the participants' knowledge of heuristics, or mental short cuts. Appendix C contains a complete list of knowledge questions asked.

Judgment Accuracy Tests

The judgment accuracy tests were the most important assessments of the experiment, as these tests measured the participants' detection accuracy. The participants were third person observers of interview scenarios. The tests consisted of six interview scenarios in which the interview respondent was either honestly or deceptively replying to the interviewer. Each test contained three truthful and three deceptive messages presented in various media. The media levels of the scenarios were, from highest to

lowest richness level, video (with audio), audio only, or text; each test contained two questions of each media type. The order in which deceptive versus truthful messages were presented was randomly assigned, as was the order of the media richness level of each scenario.

These interview scenarios were all developed from controlled experiments designed by experts in the field (Buller et al., 1994b; Burgoon et al., 1994; Burgoon et al., 1999). The video and audio clips were all in interview format, and the interviewer and interviewee roles were both filled by research participants. During the interview the interviewer asked the interviewee emotional, factual, and opinion questions, and the interviewee responded to some of the questions truthfully and some dishonestly as assigned by the researchers. The interviews were taped from a concealed video camera for later analysis. These interviews originally included several questions, and lasted up to fifteen minutes. For the current experiment, the interviews were edited into clips containing only one lead question and any related questions asking for clarification or further explanation of the response. The edited clips ranged from one to three minutes in length. Not only were these clips presented in video and audio formats, but some were also presented as transcripts for the text examples.

Some of the text examples were transcripts from face-to-face interviews, but the majority of text examples were transcripts from online chat interrogations. These examples were developed during the mock theft experiment described in Chapter One. In this experiment, the interviewee was questioned about a missing wallet during a synchronous chat session (Research Consortium, 2002). Some of the interviewees were instructed to answer the questions deceitfully while others were expected to give honest

replies. The transcripts were presented to the participants of the current experiment; they were given two and a half minutes to read the chat transcript and assign a veracity judgment to the interviewee.

As mentioned before, some researchers have criticized the test of third person observers' deception abilities as outdated and unrealistic (Buller and Burgoon, 1996b). However, it has also been argued that observers "offer viable perspectives on interaction," and that studying observer ratings of veracity still remains important in deception research (Burgoon et al., 1996:57). In this study, the third person observer role is actually quite realistic considering the interest is in deception over electronic media. The use of the video examples can be equated with a manager viewing an interview over a video teleconference. The use of the audio example is equivalent to listening to an audio only chat session, or the more common speakerphone conversation. The text examples used are actually chat session transcripts, which could be comparable to observing electronic mail traffic. These comparisons clarify why the use of an observer as opposed to a co-participant is acceptable for this experiment.

Standardized judgment test administration procedures were scripted and provided to each instructor. The instructors first handed out a document describing each of the six scenarios to the participants (see Appendix D for an example of the document). The instructor would give a short introduction to each scenario and then project the scenario from the instructor computer. The video and text messages were displayed on the overhead, while the audio messages were simply played for the class over the computer's speakers. The text messages were also provided on the handout so participants were able to read at their own pace. After each scenario was displayed the participants were

instructed to record their answers, truthful or deceptive, both on their handout and on the web-based form.

The detection accuracy test scores were calculated based on the number of correct responses to both the truthful and the deceptive messages. Each participant had a detection accuracy score ranging from zero to one-hundred percent for all six tests. In order to test the hypotheses presented in Chapter Two, only selected detection accuracy scores were used. The hypotheses pertaining to the communication medium characteristics required investigating the detection accuracy of specific questions, as opposed to the raw score. The accuracy of video scenarios, audio scenarios, and text scenarios were calculated and used to test the hypotheses (H1a, H1b, H1c, H2a, H2b) pertaining to differing communication medium characteristics. The media specific accuracy score was determined by grouping the questions of each media type, and calculating the percentage of correct answers for each media type across the four judgment tests of sessions one and two. This method provided a video, audio, and text accuracy score for each participant. Session three detection accuracy results were not used to test these hypotheses due to attrition of participants. The results for a participant are only valuable for analysis of these hypotheses if they were present for each session included. Using only session one and two results provides a larger sample size for analysis, this is especially important considering the already small sample of females (n=16).

Training and Feedback

The training was the treatment in this experiment; sessions one, two, and three each included fifty minute training sessions, developed by experts in the field, which

varied in content. Training was provided to groups one, two, and three; group four was not exposed to any training. The session one lecture provided a broad overview of deception topics and definitions of commonly used terms. Session two training curriculum covered specific indicators of deception, and characteristics of truthful messages. Heuristics, as a hindrance to deception detection, were discussed in the session three lecture. The instructors rotated groups throughout the experiment to prevent instructor bias. For sessions one and three, all the training was provided by an instructor using a Microsoft PowerPoint slide show as a visual aid; this type of instruction is referred to as traditional training for the purpose of this study. Session two, however, was presented in three different formats.

Session two expanded on the base knowledge provided in the overview lecture of session one, and covered specific indicators of deception. In the interest of another research effort, the cues training was provided via three different delivery modes. The traditional training lecture with an accompanying slide show was presented to one group. This lecture also included examples similar to the interview scenarios used for the deceptive judgment tests, and enacted military oriented examples. In the traditional training treatment group, these examples were projected on an overhead as appropriate throughout the lecture. Another group received the same content via the software-based training mechanism, referred to in Chapter One as the Agent99 virtual classroom. The Agent99 treatment group had access to a videotaped lecture, mirroring the lecture provided to the traditional training group, and the examples mentioned above. Participants viewed the contents of Agent99 on a personal computer with a set of headphones. They were given complete freedom to view all of the contents, in any order,

within the fifty minute training period. The third treatment group was lectured with the same slideshow as the traditional training group; however, the examples were not played during the lecture. Rather, the participants were given the opportunity to view the examples within the Agent99 virtual classroom, after the lecture was complete. The group was given both traditional classroom training and software-based training, so this treatment is referred to as combination training. Although different delivery modes were employed, all the groups were provided with exactly the same training content.

Given that past research has shown cues training to be beneficial to deception accuracy scores (deTurck, 1990; deTurck, 1991; deTurck and Miller, 1990; Fiedler and Walka, 1993; Porter et al., 2000), the performance measures from this session were utilized in the hypothesis testing. Considering all groups received the same lecture content, the delivery mode is not a concern to this research. The groups that received training were combined to form the treatment group, and the group that did not receive training is the control group. The detection accuracy performance scores from the session two post-test were compared to the baseline assessment detection accuracy scores from session one to test the training hypothesis.

Following the second judgment accuracy assessment, all groups (including the control group) received feedback on their accuracy judgments. The instructor simply read off whether the scenarios were truthful or deceptive. No further explanations of the messages were provided; the instructor did not point out any deceptive cues the interviewee displayed or comment on what they lied about. Considering the lack of content provided about the message, past research would suggest (Zuckerman et al., 1984) the feedback will have no significant impact on deception performance.

Survey

As this experiment was a collaborative effort, many different measurements were taken throughout the duration. The trust measurement, described in detail earlier, is the only survey of interest to this thesis effort. This survey was administered to the participants during the initial data collection (session zero) and after training in session two. The trust scale has previously demonstrated reliability at a level of .77 to .85 (Macdonald et al., 1972; Rotter, 1967). The Cronbach's alpha reliability coefficient was equal to .79 for the session zero survey and .78 for the session two survey. This is an acceptable level of reliability for this type of measure (Nunally and Bernstein, 1994).

The session zero trust measurement was used to test Hypothesis Three; this measurement provides the best representation of the participants' dispositional trust, because it was taken before training and all other treatments. The trust score from session zero was compared to the detection accuracy from session one, in order to determine if a relationship exists between dispositional trust and pre-training detection accuracy. The trust measure from session two was not used to test any hypotheses, but simply to ensure the stability of the trust measurement. An analysis revealed mean scores of 82 for the first trust measure, and 81.5 for the second trust measure. A pairwise correlation analysis showed high test-retest reliability ($\alpha = .72$). This is higher than the correlation of .56 reported by Rotter (1967).

Summary

This chapter described the research design and methodology used to measure the hypotheses presented in Chapter Two. The method of measuring the participants' trust level, and their detection accuracy was delineated. In addition, the experiment activities were described in detail. The following chapter discusses the analysis of the data collected during the experiment. Results of the data analysis will be discussed in Chapter Five along with the limitations of the research, implications of the results, and suggestions for further research.

IV. Data Analysis

Overview

This chapter describes the results of the experiment, described in Chapter Three, and outlines the statistical procedures used to analyze the stated hypotheses. The participation rate is discussed and a statistical description of the participants is provided, followed by a statistical analysis of each of the hypotheses proposed in Chapter Two. Discussion and implications of the results will be provided in Chapter Five.

Description of Participants

Although the original number of participants expected in each class was sixteen, the number varied from class to class. The class assignments were based on the date the students were available to start training; due to administrative problems and scheduling oversights, some class sizes ranged from fourteen to seventeen students. Overall, 119 students (103 males and 16 females) provided usable data in session zero of the experiment. However, some of the students were not present at all of the sessions of the experiment. Due to the longitudinal design of the experiment, only data from students participating in each session was useful in testing the majority of the hypotheses. Session two only had 117 (101 males and 16 females) participants, while session three lost even more participants ending with a total of 115 (101 males and 14 females) students. Given the necessity to retain as many female participants as possible for hypothesis testing, the

researcher decided to only use data from sessions zero, one, and two. Not including the last session allows for a sample size of 117 (101 males and 16 females).

The participants were divided into four groups, as described in Chapter Three. However, only two groups, the control group and the combination of all three trained groups, were of interest to this research effort. Using only data through session two of the experiment, the control group had 28 participants, and the treatment group had 89. To ensure equivalency between groups, the scores from the first judgment accuracy tests were compared across the groups; the control group had an initial detection accuracy of 47% (standard deviation (SD) = .18) and the treatment group had 51% average (SD = .21); no significant differences were found ($F = .83$, $p > .05$). Overall, the mean pre-training detection accuracy scores of all groups was equal to 50%. These findings are aligned with past research, which suggests detection accuracy is no better than chance in most cases (DePaulo et al., 1985; Zuckerman et al., 1981). However, of interest to this study is the analysis of the data in relation to the hypotheses proposed. The following sections recap the hypotheses stated in Chapter Two, present the results, and report the conclusions.

Analysis of Medium Characteristics

In reference to medium characteristics (i.e. video, audio, and text), Hypotheses 1a, 1b, and 1c proposed media richness will have a significant positive effect on detection accuracy. Specifically, Hypothesis One stated that (a) detection accuracy will be significantly higher when judging video messages than when judging text messages, (b)

detection accuracy will be significantly higher when judging video messages than when judging audio messages, and (c) detection accuracy will be significantly higher when judging audio messages than when judging text messages.

The mean scores, for each media type, were calculated (as described in Chapter Three) for all participants who provided complete data (n = 117). The means aligned with the order proposed in the hypotheses. That is, the video questions, with a 69% accuracy rate, rated higher than the audio scores, which provided a 62% accuracy rate, which in turn was better than the average text score of 50%. Therefore, further testing was conducted to determine if significant differences were present between the media types.

Testing Hypotheses 1a, b, and c involved testing paired measures, in order to simplify this test from a multivariate analysis to a univariate analysis, a derived variable was created by calculating the difference of the paired values (Kachigan, 1991). A Student's t-test, or simply t-test, was then performed to determine if the difference was significantly greater than zero ($\alpha = .05$). The results of the Hypothesis 1a, b, and c analyses are summarized in Table 3. To test Hypothesis 1a, which proposed participants would perform better in a video environment than in a text environment, the difference between the video scores and the text scores of each participant was calculated. The average difference of the mean video and text scores was found to be 19% (n = 117). A t-test indicated that the difference was significantly greater than zero with a test statistic of 10.63 ($p < .001$). In this study, participants performed significantly better at distinguishing truth and deception when presented with video scenarios than when presented with text messages; thus Hypothesis 1a was supported.

Hypotheses 1b and 1c were tested with the same method as described for Hypothesis 1a. An analysis was conducted to determine if the data showed support for Hypothesis 1b, which suggested video scores would also be significantly better than audio scores. The mean difference between video and audio scores was calculated to be 7.8%; a t-test was performed and indicated support for the hypothesis ($t = 4.55$; $p < .001$). Thus, participants had better detection scores when presented with video clips than when presented with audio clips. Hypothesis 1c, which states that participants' detection accuracy would be higher when judging audio messages as opposed to text messages, was tested using the same methodology. The mean difference in audio and text scores was found to equal 11.6%. The t-test returned a test statistic of 6.03 ($p < .001$). Thus, support was found for Hypothesis 1c. Participants had better detection scores when presented with audio clips than with text messages. Overall, Hypotheses 1a, 1b, and 1c were all supported, showing that media richness had a significant positive effect on detection accuracy.

Table 3: Hypothesis 1a, 1b, and 1c Analysis

Media Characteristics					
Accuracy Scores	**n**	**Mean**	**Std Dev**	**Test Statistic**	**p value**
Video	117	.694	.143		
Audio		.616	.149		
Text		.50	.156		
Video - Text		.194	.198	10.62	< .0001
Video - Audio		.078	.185	4.55	< .0001
Audio - Text		.116	.208	6.03	< .0001

Analysis of Gender Differences

Hypothesis 2 predicted that females would perform better than males in a richer environment, but they would fail to maintain this advantage in a lean media environment (Hypothesis 2b). Specifically, it was expected that women would better distinguish deception from truth than males when presented with video clips, and perform equal to males when presented with text messages.

The relationship between detection accuracy, within various media types, and gender was of interest in the analysis for this hypothesis. An appropriate test to investigate a relationship between a qualitative variable (gender) and the performance of a task (detection accuracy) is an analysis of variance test (ANOVA) (Huck and Cormier, 1995). Two separate one-way ANOVAs were used to evaluate the gender differences in the detection accuracy scores within the media type (i.e. video and text). One important point to note before the presentation of this analysis is the limitation introduced by the small sample size of females (n=16). A power analysis revealed the sample in the current study provides a very low power for both the video score by gender analysis (power = .28), and the text score by gender analysis (power = .32). This limitation should be considered when results are reviewed. Significant differences may exist where none are found within this particular experiment because of insufficient and uneven sample sizes (Huck and Cormier, 1995).

To test Hypothesis 2a, a one-way ANOVA of gender differences on video detection accuracy was performed. The test yielded an insignificant F ratio (1,115) of 1.92 ($p > .05$). This test showed no significant gender differences in a media rich environment; thus, Hypothesis 2a was not supported. A one-way ANOVA was also

performed to test Hypothesis 2b. The test investigated gender differences in text based detection accuracy. This test returned an insignificant F ratio (1,115) of 2.92 ($p > .05$). These results are summarized below, in Table 4. These results support Hypothesis 2b, which suggested no significant gender differences would be present in the lean media environment. However, considering the low power of this test, there is a large probability of finding no significant differences when in fact significant differences do exist, or committing a type II error (Kachigan, 1991). Given the low power, rather than reporting support for Hypothesis 2b, moderate support will be reported. In summary, no gender differences were found in this analysis; thus Hypothesis 2a was not supported, and Hypothesis 2b received moderate support.

Table 4: Hypothesis 2a and 2b Analysis

Video Detection Accuracy by Gender					
Gender	**Group n**	**Mean**	**Std Dev**	**Univariate F**	**p value**
Females	16	.648	.146	1.92	> .05
Males	101	.702	.142		
Text Detection Accuracy by Gender					
Gender	**Group n**	**Mean**	**Std Dev**	**Univariate F**	**p value**
Females	16	.554	.176	2.29	> .05
Males	101	.491	.152		

Analysis of Trust Levels

Hypothesis 3 proposed that trust would have a significant negative influence on deception detection accuracy. In particular, it was expected the higher an individual's score on the trust scale, the less accurate his or her detection performance would be.

The trust measurement described in Chapter Three was used to determine each individual's level of dispositional trust during session zero. The trust scale had a possible

range of 25 to 125, with 125 being the highest trust level. Specific scoring information is provided in Appendix B. The participants in the experiment reported scores ranging from 60 to 113, with the mean score equal to 82 (SD = 9.86). The reliability coefficient of the trust items was found to equal .79, as reported in Chapter Three.

A simple linear regression was performed to determine if a relationship exists between the dispositional trust score and pre-training detection accuracy (Kachigan, 1991). Given that only data from session zero and one are needed to test this hypothesis, all 119 participants' data was included in this analysis. The regression returned an insignificant r^2 value of .003 ($p > .05$). This low value implies that the trust scores predict little to none of the variance present in the detection accuracy scores. These results are also presented in Table 5. Overall, no support was found for Hypothesis 3. Trust, as measured by Rotter's (1967) trust scale, did not negatively influence detection accuracy.

Table 5: Hypothesis 3 Analysis

Regression Trust Score by Pre-Training Accuracy				
n	**r2**	**β**	**Standard Error**	**p Value**
119	.003	.05	.001	>.05

Analysis of Training Differences

Hypothesis 4 suggested that training would have a significant positive effect on deception detection accuracy. More explicitly, it was expected that the participants would significantly improve their detection performance after the cues training session.

The post-training scores used were from judgment accuracy test 2b, the second test of the second session; the pre-training scores were the scores received on the first judgment accuracy test, test 1a. In order to simplify this test from a multivariate analysis to a univariate analysis, a derived variable was created by calculating the difference of the test scores, and then an ANOVA was performed with the derived variable (Kachigan, 1991). Table 6 summarizes the results of the Hypothesis 4 analysis. To test Hypothesis 4, a one-way ANOVA of group differences (trained versus untrained) on the detection accuracy differences was performed. The test yielded an insignificant F ratio (1, 115) of 1.85 ($p > .05$). This test showed no significant group differences in detection accuracy score improvement. However, an inspection of the mean scores for each group showed a difference between the trained and untrained groups on the individual tests. To further explore this difference, a one-way ANOVA of group differences on post-training scores was performed. This ANOVA returned a significant F ratio (1, 115) of 13.74 ($p < .001$). Recall, no significant differences were found between the groups on the pre-training judgment accuracy test. This analysis shows that the trained group did perform significantly better on the post-training test than the untrained group. However, the trained group's improvement (difference of the post-training score and the pre-training score) was not significantly higher than the untrained group's improvement. The results of the above analyses provide moderate support for Hypothesis 4.

Table 6: Hypothesis 4 Analysis

Differences: Post-Training Test – Pre-Training Test					
Group	**Group n**	**Mean**	**Std Dev**	**Univariate F**	**p value**
Trained	89	.096	.252	1.85	> .05
Untrained	28	.024	.212		
Pre-Training Detection Accuracy by Group					
Group	**Group n**	**Mean**	**Std Dev**	**Univariate F**	**p value**
Trained	89	.511	.211	.83	>.05
Untrained	28	.47	.176		
Post-Training Detection Accuracy by Group					
Group	**Group n**	**Mean**	**Std Dev**	**Univariate F**	**p value**
Trained	89	.607	.143	13.75	< .001
Untrained	28	.494	.132		

Summary

This chapter described the analysis of the data and presented the results of the experiment. The analyses showed support for Hypotheses 1a, 1b, and 1c, and partial support for Hypotheses 2b and 4. No support was found for Hypotheses 2a and 3. A discussion of these results as well as complete review of the implications, applications, and limitations of this study will be discussed in Chapter Five.

V. Conclusions and Recommendations

Overview

The focus of this research effort was to investigate how information processing biases and training programs relate to deception detection performance. Hypotheses were developed based on past research findings and current theory, and an experiment was performed to test these hypotheses. The findings of the experiment are summarized in Table 7. This chapter will discuss the implications, limitations, and suggestions relating to the study and its findings.

Table 7: Summary of Findings

Hypothesis	Result
H1a: Deception detection accuracy will be significantly higher when judging video messages than when judging text messages.	Strongly Supported
H1b: Deception detection accuracy will be significantly higher when judging video messages than when judging audio messages.	Strongly Supported
H1c: Deception detection accuracy will be significantly higher when judging audio messages than when judging text messages.	Strongly Supported
H2a: Females will be more accurate at detecting deception than males in a rich media environment.	Not Supported
H2b: No significant gender difference of deception detection accuracy will exist in a lean media environment.	Partially Supported
H3: Trust will have a significant negative influence on deception detection accuracy.	Not Supported
H4: Training will have a significant positive effect on deception detection accuracy.	Partially Supported

Discussion

Collectively, Hypotheses 1a, 1b, and 1c proposed media richness will have a significant positive effect on detection accuracy. Statistical tests supported these

hypotheses, showing participants to be significantly more accurate at distinguishing veracity in a video environment as opposed to either an audio or text environment. Similarly, it was also found that when presented with audio messages, participants had higher judgment accuracy than when presented with text messages. These findings were expected, as they align with the continuums of cue availability offered by both Media Richness Theory and Social Presence Theory (Daft and Lengel, 1986; Short et al., 1976), and reinforce the fundamental concept that observation of cues is necessary for deception detection (Buller and Burgoon, 1994a).

Contrary to Hypothesis 2a, no gender differences were discovered in deception detection abilities in a rich media environment. Rather, the statistical analysis returned no significant differences between the video judgment accuracy scores of males and females. These findings are contradictory to past research which suggests that women are more accurate at detecting deception in a cue rich environment given their superiority at perceiving nonverbal deception correlates (deTurck, 1991; McCornack and Parks, 1987). However, given the small number of female participants, the probability of finding a significant difference is quite low. This inconsistent result could also stem from the poor quality video of the interview clips (Horn, 2001). The video scenarios were taped from a hidden camera, and the resolution was less than desirable. The poor quality video could have filtered out seemingly insignificant nonverbal cues (Horn, 2001), which women may have observed, more proficiently than men, in a better quality video or in a face-to-face situation.

Hypothesis 2b suggested that when presented with text-based messages no gender differences would be found. Although the statistical analysis did not reveal any gender

differences in text-based judgment accuracy scores, Hypothesis 2b can only be partially supported with the results from this experiment. This relates back to the small number of female participants, which limited the study's power. However, the results have theoretical support, which asserts the lack of cues will impede women from out performing men in perceptual tasks in lean media environments (Dennis and Kinney, 1999).

Contradictory to Hypothesis 3, no relationship between dispositional trust and detection accuracy was discovered. This lack of correlation can be a consequence of many factors. First of all, there is the possibility that there is actually no relationship between trust, as measured by Rotter's (1967) trust scale, and detection accuracy. However, this is not necessarily the case; the lack of connection between the constructs could have also resulted from the research design. As discussed in Chapter Two, increased suspicion often decreases reliance on the truth bias and trust (Levine and McCornack, 1992; Millar and Millar, 1998). In the experiment, the participants were explicitly told to determine the veracity of the messages, and informed some were truthful and some were deceptive. Given this procedure, it is possible individuals were not relying on their general trusting or untrusting characteristics, but rather simply adhering to the guidance of the experiment administrator.

Hypothesis 4 proposed that training would significantly increase judgment accuracy; this hypothesis received partial support. The statistical tests showed no significant differences in the level of improvement from pre-training scores to post-training scores between the control group and the trained group. However, analysis did reveal the trained group performed significantly better than the untrained group following

the second training session. Still, only partial support can be reported for Hypothesis 4, because the improvement of the trained group cannot be attributed to training alone, considering the control group also showed improvement. The lack of significant differences in improvement can be a result of various factors. Specifically, the control group could have improved due to feedback provided following the judgment accuracy tests in the first session (Porter, 2000), or simply due to the past experience with the judgment test format and procedures (Huck and Cormier, 1995). In addition, the trained group may have not performed to an optimal level due to a fatigue effect (ibid). This is a plausible explanation considering the trained group had sessions lasting three hours with only a ten minute break, while the control group was released for a break (approximately 50 minutes) between judgment tests.

Limitations

With regards to the above results, several limitations of the research effort must be acknowledged. To begin with, general limitations in the research design could have prevented an optimal investigation of detection accuracy. Miller and Stiff (1993) assert that generalizable deception research procedures should provide participants with motivation to detect deception. It is acknowledged that this research design did not provide a sufficient means of motivation to the participants. Another issue is that participants were limited to a dichotomous scale (truthful or deceptive) when responding to judgment accuracy tests, as opposed to a more stratified scale which may have been more appropriate (Burgoon et al., 1999). In addition, the experiment administrators

observed that the group environment in which the experiment was conducted may have introduced a confounding effect. A more desirable arrangement would have limited the visibility of other participants during the judgment tests to ensure facial expressions, comments, or actions of other participants would not influence veracity decisions.

Additionally, some hypothesis-specific limitations may have limited the findings relating to the specific areas of interest to this thesis effort. Most of these limitations stem from the fact that the experiment was designed to explore numerous topics, in addition to the areas of interest to this thesis effort. A possible limitation of the medium characteristics findings lies in the fact that different scenarios were provided for each media type. Although difficulty level was assessed and attempts to control for the differences were made, it is possible the difficulty level varied across media types. In addition to the already mentioned small female sample size, another possible limitation of the gender investigation lies in the fact that the senders' gender was not taken into consideration or controlled for in this experiment. In reference to the trust findings, the design of the experiment, which induced suspicion, most likely inhibited the exploration of the relationship between trust and detection accuracy. A final limitation, pertaining to the training measurement, is that all groups, including the control group, received feedback on their judgment accuracy throughout the study. This prevented a comparison of the trained group to a true control group. Regardless of these limitations, the findings of this study are still useful to both practitioners and academics.

Implications for Practice

This research shows Air Force communications and information personnel are not proficient at detecting deception. While this is not necessarily a surprise, considering past research suggests the majority of people are not (Miller and Stiff, 1993; Vrij, 2000; Zuckerman et al., 1981), it should be a concern to the Air Force. If the Air Force intends to meet the objectives of information and decision making superiority, the personnel responsible for information assurance must be able to detect deception in communications.

An increased concern, for both the Air Force and other organizations, should stem from the results which indicate individuals are less accurate at detecting deception in lean media. Increasingly in business today, communications and negotiations are conducted via lean media such as video conferencing, teleconferencing, and synchronous and asynchronous text-based electronic communication (Dennis and Kinney, 1999; Mohan, 1995; Wachter, 1999). This increased use of electronic means of communication equates to increased vulnerability to deception (Zmud, 1990). This study suggests that communications personnel are less accurate at detecting deception within lean media. Organizations should take this finding into consideration when conducting vital communications and negations over electronic media.

Another finding of the study shows that organizations can improve the poor detection abilities of personnel through practice, feedback, and training. The study showed improvement in both the trained group and the control group detection abilities. This enhancement of detection abilities shows that organizations can increase judgment accuracy among personnel, by implementing even a brief training session which provides

feedback and encourages practice. Intensive training may not always be possible in organizational settings; the knowledge that detection ability can be improved through less extensive programs is of practical utility. However, it is also important to note that the trained group did perform better than the untrained group following a training session on deception cues; this suggests organizations may benefit from providing more intensive training to personnel in positions more sensitive to deception attempts.

Academic Implications and Suggestions

This research suggests that the richness or leanness of media can affect an individuals' ability to decode information. This shows that Media Richness and Social Presence Theories may have some explanatory power relating to investigations of deception detection abilities. Further investigation in this area is warranted. Specifically, a study examining media type across groups, as opposed to within groups, using the same scenario presented in various medium types would help further the understanding of this area. In addition, when studying diverse media types, including a face-to-face judgment test for comparison to other levels of media richness would be beneficial.

Another benefit to researchers is the finding that the untrained participants, as well as the trained participants, improved in their detection accuracy. Although this may have been due to practice, it is more likely a result of the feedback received during the first session. This finding suggests that general feedback on detection accuracy may improve performance, conflicting with previous finding that only sender specific feedback is beneficial (Zuckerman et al., 1984). The topic of feedback should be further

investigated. A study comparing groups receiving no feedback or training to groups receiving feedback would be beneficial to the understanding of the effects feedback has on judgment accuracy.

Conclusion

Results from this study suggest that medium characteristics affect individuals' deception detection ability. In addition, it was also shown that deception detection abilities did improve with practice, feedback, and training. These results are beneficial to the understanding of deception detection from both a practical and academic point of view. The lessons learned from the limitations of this experiment can be applied to future experiments to further investigate information processing biases and training effects as related to deception detection.

Appendix A

Demographic Information

Please select a Group
Group 1 Group 2 Group 3 Group 4

Please enter the Last 4 digits of your SSAN?

Please select your gender
Male Female

Please select your Rank
2LT 1LT CAPT MAJ LTCOL COL Enlisted Civilian

Please enter your Age in Years?

Number of years you have been in Communications career field (include prior enlisted time)?

Please select your Highest Level of Educational degree obtained?
High School Associates Bachelors Masters Doctoral

How many years have you been working with computers?

Approximate percentage of your duty day spent on a computer?
< 25% 25% - 50% 50% - 75% 75% - 100%

Approximate number of off-duty hours spent on the computer per week
None 1 – 5 6 - 10 11 – 20 > 20

How many online classes or online training courses have you taken before? Including classes taken during duty and off-duty time.

Appendix B

Interpersonal Trust Scale (Rotter, 1967)

Directions

Indicate the degree to which you agree or disagree with each statement by using the following scale:

5= strongly agree
4= mildly agree
3= agree and disagree equally
2= mildly disagree
1= strongly disagree

1. Hypocrisy is on the increase in our society.

2. In dealing with strangers one is better off to be cautious until they have provided evidence that they are trustworthy.

3. This country has a dark future unless we can attract better people into politics.

4. Fear of social disgrace or punishment rather than conscience prevents most people from breaking the law.

5. Using the honor system of *not* having a teacher present during exams would probably result in increased cheating.

6. Parents can usually be relied on to keep their promises.

7. The United Nations will never be an effective force in keeping world peace.

8. The judiciary is a place where we can all get unbiased treatment.

9. Most people would be horrified if they know how much news that the public hears and sees is distorted.

10. It is safe to believe that in spite of what people say most people are primarily interested in their own welfare.

11. Even though we have reports in newspapers, radio, and T.V., it is hard to get objective accounts of public events.

12. The future seems very promising.

13. If we really knew what was going on in international politics, the public would have reason to be more frightened than they now seem to be.

14. Most elected officials are really sincere in their campaign promises.

15. Many major national sports contests are fixed in one way or another.

16. Most experts can be relied upon to tell the truth about the limits of their knowledge.

17. Most parents can be relied upon to carry out their threats of punishments.

18. Most people can be counted on to do what they say they will do.

19. In these competitive times one has to be alert or someone is likely to take advantage of you.

20. Most idealists are sincere and usually practice what they preach.

21. Most salesmen are honest in describing their products.

22. Most students in school would not cheat even if they were sure of getting away with it.

23. Most repairmen will not overcharge even if they think you are ignorant of their specialty.

24. A large share of accident claims filed against insurance companies are phony.

25. Most people answer public opinion polls honestly.

Scoring Key

For Items 6,8,12,14,16,17,18,20,21,22,23, and 25
Convert the recorded response
A score of: 1=5 2=4 3=3 4=2 5=1

For Items 1,2,3,4,5,7,9,10,11,13,15,19, and 24
The recorded response is the score

Add all the points together
Apply this formula to the score calculated above
(125- Raw Score) + 25= Trust Score
The higher the score the greater the trust level

Appendix C

Introduction Quiz – Session 1 *****Correct responses are in bold text**

1. Studies have shown that up to _____ of all job applicants, no matter what field or position, have lied on their resumes.
    a) 10%
    b) 25%
    c) 40%
    d) 75%

2. The concept that deceivers are not able to control indicators pointing to their dishonesty is the idea behind:
    a) leakage theory
    b) interpersonal deception theory
    c) truth bias
    d) immediacy theory

3. Typically, people successfully detect deception about _____ of the time.
    a) 20%
    b) 50%
    c) 80%
    d) 90%

4. In terms of detecting deception, the downside of being suspicious is that it might lead to:
    a) less detection accuracy
    b) more false alarms
    c) more truth bias
    d) poor cognitive processing

5. A simple way to define *deception* is:
    a) a message that is inaccurate in its content and assumptions
    b) a message that is purposely used to foster a false conclusion in others
    c) a message that contradicts the beliefs of the majority of society
    d) a message that blatantly breaks the norms of a society's culture

6. Past studies of deception detection were:
    a) limited in the amount of interaction between communicators
    b) highly dynamic in nature
    c) conducted using large groups of people
    d) looked at deceptive communication of long periods of time

7. Which of the following would NOT directly lead to better detection accuracy?
    a) familiarity with the communicative sender
    b) experience using with the communicative medium
    c) familiarity with the topic of conversation
    d) experience in high-risk situations
8. The tendency for most human beings to believe other people are honest by default is known as the _____.
    a) trust bias
    b) truth bias
    c) lie bias
    d) gullibility bias

9. In response to the question "How much experience do you have driving commercial vehicles?", the dishonest response of "Yes, I have driven a dump truck" would be an example of what type of deception?
    a) fabrication
    b) concealment
    c) equivocation
    d) misconception

10. Which of the following is NOT a reliable visual indicator of deception?
    a) increased blinking
    b) smiling
    c) pupil dilation
    d) self-grooming

11. Which of the following is NOT a linguistic property?
    a) the use of pronouns
    b) submissive language
    c) temporal distancing
    d) voice pitch

12. An example of the adaptor clue would be:
    a) shuffling feet
    b) clearing the throat
    c) increased voice pitch
    d) grooming the hair

Cues Quiz – Session 2

1. The theory that suggests deceivers will be unable to control all of their behavior while lying is:
    a) interpersonal deception theory
    b) indicator theory
    c) cognitive effort theory
    d) leakage theory

2. Deceivers are apt to display _____ -based cues if the consequences of having a lie detected are perceived to be severe.
    a) arousal
    b) emotion
    c) cognitive
    d) tactical

3. With regard to deception, we would expect _____ messages as more likely to be dishonest.
    a) longer
    b) shorter
    c) uninterrupted
    d) content rich

4. The type of deceptive cue known as a "leveler" refers to:
    a) a glaring lack of detail
    b) voice pitch fluctuation
    c) responding to a question with a question
    d) over-generalizing terms like "everyone"

5. If asked "Have you seen Joe's missing wallet?", a deceiver using the delay tactic of tag questions would respond with:
    a) "What are you implying?"
    b) "That's too bad for Joe, isn't it?"
    c) "Who are you to ask me such a question?"
    d) "Why should I have seen it? Of course not."

6. Which of the following would NOT be a reliable cue pointing toward deception?
    a) poor detail in a particular message
    b) non-ah nonfluencies
    c) lower voice pitch
    d) less positive emotion

7. Deceivers tend to use or switch to _____ in their messages.
    a) past tense verbiage

b) faster speaking tempo
c) more detailed explanations
d) formal names and places

8. The use of terms like "maybe, perhaps, could have" is the linguistic property known as:
    a) leveling
    b) immediacy
    c) hedging
    d) rephrasing

9. "Response latencies" refer to:
    a) stuttering during a message
    b) a pause before beginning a message
    c) an attempt to change the subject before addressing it
    d) using "uh's" and "ah's" during a message

10. Which of the following is a reasonably reliable indicator pointing toward deception?
    a) vocal pleasantness
    b) limited body movement
    c) monotone speaking
    d) unusual details

11. It is possible that a deceiver is having a difficult time lying if we notice him _____.
    a) respond immediately after being asked a question
    b) fail to maintain eye contact with others
    c) behave in a normal manner
    d) drop the names of others into conversation

12. When relating a past event, an honest communicator is less likely to:
    a) report on his or her emotional state at the time of the event
    b) report on unusual details about the event
    c) report on the verbatim discussion of those at the event
    d) leave out the names of people at the event

Heuristics Quiz – Session 3

1. Heuristics refer to _____.
    - **a) mental shortcuts used to quickly judge the truthfulness of information**
    - b) highly reliable rules for judging the truthfulness of information
    - c) strategies used by deceivers to successfully lie to others
    - d) methods used for accessing information that may contradict another person's statements

2. The tendency for most human beings to perceive most incoming information as truthful is known as the _____.
    - a) trust bias
    - **b) truth bias**
    - c) plausibility bias
    - d) lie bias

3. Availability bias refers to:
    - **a) judging the reliability of an occurrence based on common, similar occurrences**
    - b) basing the validity of a statement on the reliability of its source
    - c) basing the validity of a statement on how accessible supporting information is
    - d) judging the veracity of a person on how available they make themselves to others

4. An interviewer who believes the applicants he personally interviewed more than those who did not interview the applicants:
    - a) interview bias
    - b) truth bias
    - c) lie bias
    - **d) probing bias**

5. We are more likely to believe "the painful truth" from our friends than from strangers because of the:
    - a) truth bias
    - **b) familiarity bias**
    - c) friendliness bias
    - d) framing bias

6. A person who constantly scratches his arms and generally appears nervous may trigger our _____ when judging him as untruthful.
    - a) lie bias
    - **b) nonverbal conspicuousness bias**
    - c) framing bias

d) plausibility bias

7. When a receiver incorrectly judges a truthful piece of information as being untruthful, that would be scored as a _____.
    a) hit
    b) miss
    c) false alarm
    d) correct rejection

8. Deceiving someone by submitting a false initial value for them to work from is exploiting their:
    a) framing bias
    b) anchoring & adjustment
    c) plausibility bias
    d) representativeness bias

9. The tendency to treat content that sounds believable on its face as truthful is:
    a) framing bias
    b) anchoring & adjustment
    c) plausibility bias
    d) representativeness bias

10. A person who distrusts nearly everyone upon meeting them (bordering on paranoia) is susceptible to:
    a) familiarity bias
    b) arousal bias
    c) probing bias
    d) lie bias

11. If a sixteen-year old introduces herself as a medical doctor, whether honestly or not, we might be suspicious because of:
    a) unexpectedness bias
    b) familiarity bias
    c) availability bias
    d) expert opinion bias

12. Framing bias refers to:
    a) being influenced by an initial value from which to work
    b) being influenced by the way a problem is worded
    c) being influenced by the consequences of a decision
    d) being influenced by the amount of risk involved with a problem

Appendix D

Example: Judgment Accuracy Description Handout (from Test 1a)

There are six conversations in this test. Each conversation may be a videotaped interview, an interview with only audio, or a piece of text from an online chat or a transcript of interviews. Some conversations are truthful but others are deceptive. Please carefully assess the conversations, and try to identify whether they are truthful or deceptive. You have 15 minutes to finish this test.

Question 1: This is an audio recording from an interview. The interviewer is asking the interviewee "Please describe your educational background." Please listen to the interviewee's answer carefully, and identify whether his/her answer is truthful or deceptive.

Question 2: This is a transcript from a face-to-face interview. The interviewer (**Q**) is asking the interviewee (**A**) "What event from your childhood do you remember most fondly?" Please read the interviewee's answer carefully, and identify whether his/her answer is truthful or deceptive.

Conversation:

Q: Uh, what event from your childhood do you remember most fondly?
A: Mm, that's a tough one, most fondly, oh, it would probably be um, the Wisconsin State Fair, I got a red and white teddy bear about this high. won it myself, no one had to win it for me.

Q: You won that by yourself, how'd you do that?
A: Throwing darts, at balloons

Q: Mmm.
A: Popping balloons

Question 3: This is a video recording from an interview. The interviewer is asking the interviewee "Please describe your current or last occupation." Please watch the interviewee's answer carefully, and identify whether his/her answer is truthful or deceptive.

Question 4: This is an audio recording from an interview. The interviewer is asking the interviewee "How ambitious are you?" Please watch the interviewee's answer carefully, and identify whether his/her answer is truthful or deceptive.

Question 5: This is a video recording from an interview. The interviewer is asking the interviewee "Please describe a typical day of your work." Please watch the interviewee's answer carefully, and identify whether his/her answer is truthful or deceptive.

Question 6: This is a transcript from a face-to-face interview. The interviewer (**Q**) is asking the interviewee (**A**) "What types of people tend to rub you the wrong way?" Please read the interviewee's answer carefully, and identify whether his/her answer is truthful or deceptive.

Conversation:

Q: Um, what types of people tend to rub you the wrong way?
A: .....mm, let's see uh, there's a million types of people, uh, umm, let me think: controlling.

Q: Why?
A: People that control me.

Q: Are we talking, total control or are we talking, um, basically are you, this is just a general broad based, be, give me an example, give me a situation when you consider
A: Anyone that has control over me

Q: You're in the army, you're being controlled everyday
A: Yeah, like I said there are numerous types of those people i don't like

Q: But then you're saying that you don't like any of your superiors.
A: I just don't like people who control me.

Q: But you put up with the military, you're, as high ranked as you are.
A: Yeah, I know. But they, like you said, you asked me if they rub me the wrong way, so I, anybody, I like to be in control and when somebody has control over me, they rub me the wrong way."

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14. ABSTRACT

The Department of Defense is increasingly relying on computer-mediated communications to conduct business. This reliance introduces an amplified vulnerability to strategic information manipulation, or deception. This research draws on communication and deception literature to develop a conceptual model proposing relationships between deception detection abilities in a computer-mediated environment, gender, trust, and training. An experiment was conducted with 119 communications personnel to test the proposed hypotheses. No relationship between gender or trust and deception detection accuracy was found. Partial support was found showing that training improves deception detection accuracy. The most significant finding was that individuals' deception detection abilities deteriorate in lean media environments. The results showed significant differences in deception detection abilities across media types; indicating lower accuracy rates in the lean media environments (i.e. audio and text). This suggests that deception detection is more difficult when the deceptive message is presented in a lean medium such as a text only online chat, than when delivered in richer medium. Future research should be conducted to further explore this finding.

15. SUBJECT TERMS

Deception Detection, Media Richness, Gender Differences, Trust, Detection Training

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